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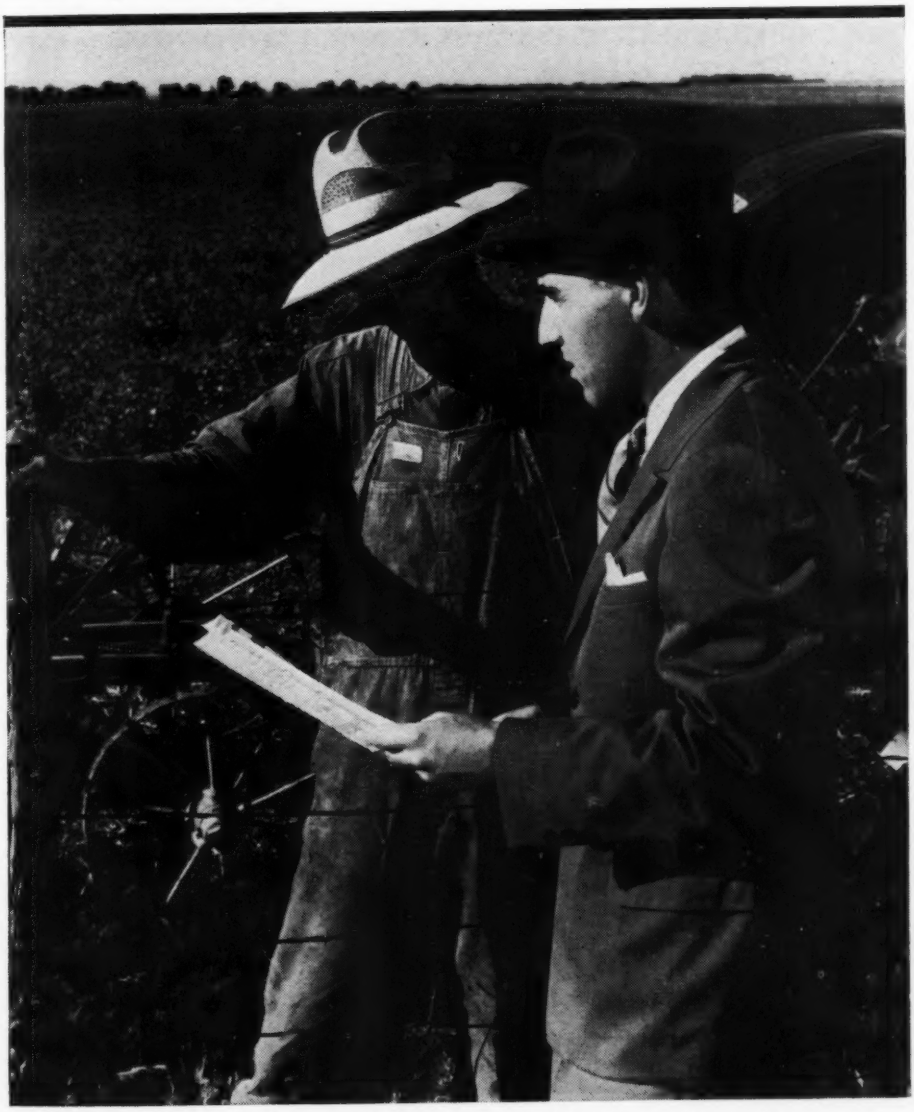

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Better Crops with PLANT FOOD

The Whole Truth—Not Selected Truth

R. H. STINCHFIELD, *Editor*

Editorial Office: 1155 16th Street, N. W., Washington 6, D. C.

VOLUME XXX NO. 5

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THE ROMANCE OF THE BLOSSOMS

Better Crops with PLANT FOOD

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Let's Consider . . . . . .

PARITY AND CHARITY

Jeff McDermid

THE chaste moon of Charity has temporarily eclipsed the blazing sun of Parity in our agricultural astronomy. Since the world food plight soaked into our domestic landscape like a sudden flood, the protagonists of parity at any price limit have behaved decently indeed toward the upsurge in demand for bread grains, fats, and oils. They have endorsed the program of famine relief in general, with a few reservations on administrative details and in respect to keeping a proper balance between cereal growing and consumption and grain feeding and livestock raising.

Of course, it is understood that in thus dealing gently with charity we won't neglect our pet parity principles to the point of complete extinction, meaning that farmers will get the current price levels consistent with the ideology and formulae inherent in the parity theory. In fact, by virtue of the bonus being paid for bin scrapings of corn and wheat, the growers of these grains will wind up the season with parity plus—and it will be through a bona fide transaction instead of a sneaking, black-market evasion game.

Inasmuch as it is felt behind the scenes that this famine situation is not something that the 1946 harvests will cure, and that foreign exports will tax our reserves to the limit for a couple of years more, one is obliged to admit that the moss-grown surplus bogey may not give us the hee-bee-jeebies for awhile at least. Whether its gibbering, ghoulish presence will be forever banished by the ambitious hopes of Food and Agriculture Organization is another prob-

lem not yet ready for a direct reply. To be sure, their arguments and world-vision planning emphasize the shame of surplus fretting and frustration, but the "how-to-do" is another thing.

And after all, I don't believe I've read a booklet in some time that touched me on the sane side or made me burp more "amens" than the FAO screed put out by Gove Hambidge and staff a few weeks back. If we can get something going along the lines therein suggested, and keep our present charity mood and world brotherhood feeling alive long enough to forestall those back-washes of ennui and forgetfulness, maybe this is going to turn out fine after all.

THAT old surplus spectre was a nightmare of hag-ridden dreams for more years than I can reckon without consulting BAE's latest reviews. We got so tough and disgusted that we classed surplus foods along with weeds, which are simply perfectly good plants that are slightly out of place. That surplus fetish did more to halt the progress of efficient agriculture than all the moon-phase and weather-sign traditions ever hatched. It made county extension folks quiver with anxiety every time they told ruralites how to banish bugs on their broccoli or drive weevils out of their wheat. All anybody could do to counteract it was to point to cost-saving per unit of this and that following the use of modern methods, including fertilizers. It drove more kids off the ranch than hard work. It was a one-sided outlook, too, because usually it related solely to the farm and seldom to the consumer, except that we all wished for some way to extend the stomach and appetite to keep pace with the tractor and the improved fertility.

Charity at home, that old motto of bygone days, had little place in most of the schemes for handling the surplus, except for the school-lunch and food-stamp plan. We paid producers to the limit to reduce or adjust their acreage, thinking only of the dark clouds of storage reserves in relation to active cash demand on the barrel head. We discounted the virtues of having a safe surplus with which to feed our hungry and ill-nourished generation, or at least we did that until Henry Wallace trotted out his Pharaoh story again and proposed an ever-normal granary. The actual need was far greater in some places here in the 1932-34 period than it is in some areas abroad today. Yet we did not cut much of a hullabaloo over it at the time or ask Hoover to scout around for us. (That *would* have been queer at the time, I admit.) Anyhow we almost forgot our own helpless widows and orphans and just yawped at the Government for making emergency jobs to provide them with a meal ticket to share the surplus.

The growth of the surplus scare has marched along steadily with the increase in nonfarm populations who ate more than they produced, and the accompanying decline of the God-fearing working force on farms. Maybe there's a reason for it. Economists have many on tap. Principally the blame for the surplus threat is hung on the contracting stomachs of the shiftless and luxury-loving urbanite, whose bulging pay envelopes even in plenteous times could not absorb the rich outpouring from the modern agrarian horn of plenty. Golf helped some, it is true to give those shut-in lads the exercise they needed to cry for ham and eggs, but the trouble was some of them did not play enough golf; and if they tried to get limber and hungry on ordinary gardening done in approved fashion, the stuff they toted home only resulted in less demand for the proteins currently sold by the farmers. On top of all that mess, the producers and processors got organized against each other and started hollering by radio and magazine in behalf of competing crops.

BESIDES these complications, we started to boom a greater variety of viands. Old-timers conquered the continent on a few rough staples, but the latter-day saints preached variety, so

we all fell in and followed the trail of proteins from many sources and vitamins galore, not to mention minerals and just plain appetizers. That was all right, nutritionists said so. From the farm standpoint it was pretty sound too, because it caused more diversification within limits. So both consumers and producers on the face of it were satisfied with variety food preachments. But when as aforesaid the ice cream,

the citrus, the prune, the apple, the milk, the cheese, and the meat boys all got to offering clamoring claims for consumer attention, the net result may easily have been decidedly nil on a bewildered belly, shrunk far below what the capacities of the ultimate consumer should be.

Oh, sure, and I have even seen the dairy breeders wrangle a lot about the respective merits of respective breed milks, rather than to join forces to see how much more economically and regularly they might serve the early morning trade.

Which brings me smack up against that bumbling reason for surplus accumulation, known as inefficient and costly distribution. The complexities of the distribution machinery criss-crossing the land, the web of needless duplication, the waste and the loss—all helped to make the farmer's productive efforts less effective. Even the well-intentioned plans of cooperative marketing associations to bust open this bottleneck do not have the verve and flavor they possessed a decade and more ago. Most folks smile with disdain now when somebody argues that the route from producer to consumer can be shorn of some of its velvet. Except for breaking up a few racketeering elements now levying shameful toll, the dollar-and-cent savings do not appear so likely to happen—at least not so much as back when they asked rural audiences "What happens in the dark?" It happens in broad daylight now, especially the influences of labor unions on merchandising costs.

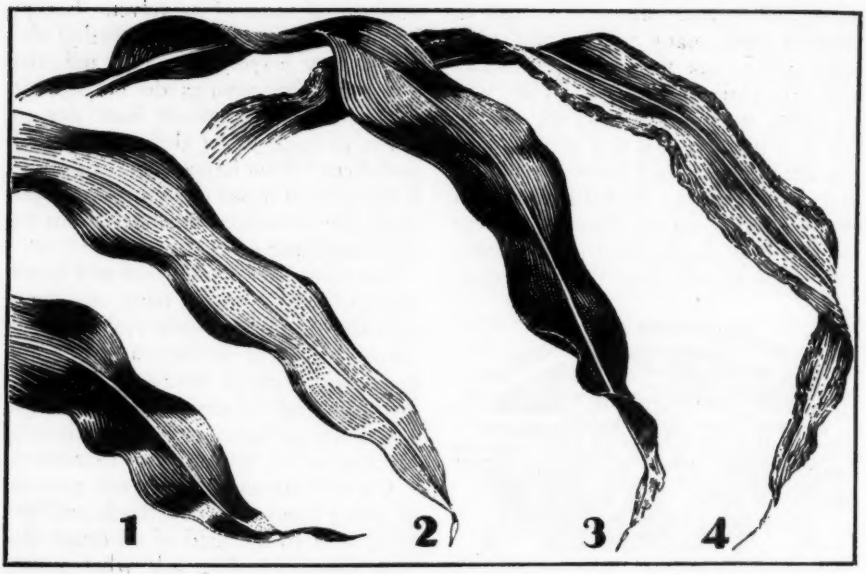
But now after a long war and much waste of food in army, navy, and overseas shipment, and little real thrift at home, we seem to face a temporary period of depleted reserves. Whether we must find the answer in more regimentation on farms and more rationing in cities is not my province to answer.

For the moment we shift our concept of parity from the pocketbook and the price level to the field of adequate human nutrition. We ask what parity means in terms of life sustenance and growth. We even ask that about ourselves in contrast to the more meager diets of those in a less bounteous land. Some of us test the food-parity principle through the use—for just a little while—of meals fashioned on the same level of calories and proteins that hungry Hungarians get.

I HONESTLY think this is rather fortunate. If this world conflict had closed without misery and hunger, no chance for the rise of vital humanitarian ideals would have occurred. I suppose other wars ended this way too, but then the world was wider and such suffering was remote and alien. Now we are neighbors one with another, thanks to science and education. Moreover, the returning veterans translate affairs abroad in ordinary home fashion and bring us nearer to the needy than ever before. It was truly said that America had its citizens in every clime during the war, and hence we are now "encompassed about with a great cloud of witnesses." This again helps to write a firmer peace, after the hungry are fed.

Economists last winter conducted a

(*Turn to page* 50)



Typical effects of plant food hunger, contrasted with normal leaf. No. 1—A healthy corn leaf; No. 2—Nitrogen starvation; No. 3—Phosphorus deficiency, chiefly indicated by a purplish hue, often very noticeable on under side as well as top, and a "firing" of the leaf tip; No. 4—potash hunger.

Learn Hunger Signs of Crops

By E. E. DeTurk

Department of Agronomy, University of Illinois, Urbana, Illinois

IN the field of human medicine, many diseases, such as rickets and pellagra, have been recognized for a long time. Physicians and research men spent years and years trying to find the microbes which caused these diseases. But in the end it was found that they were deficiency diseases, the result solely of the lack of certain essential foods. Similarly, many signs of ill health in crop plants were studied by the plant pathologists, who tried to find microbes on which to place the blame. It was a great step forward when agricultural research workers learned to catalog certain plant maladies as due to fungus or bacterial infection on the one hand, and others as due to maladjusted nutrition. The job is not done. In far too many cases our reply to Mr. Jones or Mr. Brown, who has sent us a specimen is "We do not know."

Balanced Plant Nutrition

Malnutrition signs in plants are nearly always traced to improper nutritional balance, usually a shortage of some nutrient requirement, less often a toxic or poisonous effect of too much. Just what do we mean by the well-balanced condition in the soil that we may call ideal?

It has been known for upwards of a century that some 10 chemical elements are absolutely necessary for the normal growth and reproduction of the

common crop plants. The list of these elements, written by the chemical symbols, was immortalized 40 years ago by the late Cyril G. Hopkins in the well-known C-H-O-P-K-N-S—Ca-Fe-Mg, translated, "C. Hopkns Cafe, Mighty Good, from which the I (iodine) was omitted through modesty."

Time and further investigations as well as accidental discoveries have added to this list of necessary plant-nutrient elements four others: Boron (B), Manganese (Mn), Copper (Cu), and Zinc (Zn). These four, as well as iron, are required in such extremely small amounts that they are known as trace elements, because only traces of them are needed. They are also sometimes called minor elements, but we would soon learn, if they were completely absent, that they are of major importance just as truly as phosphorus or nitrogen.

For normal growth these various elements are required in greatly differing amounts. For example, in the average healthy corn plant there is about six times as much nitrogen as phosphorus, 30 times as much nitrogen as of iron, and 1,500 times as much as of copper. What I am coming to is a definition: A well-balanced soil, as to plant feeding, is one that will deliver these different "plant-food" materials into the crop in the *right proportions*. It does *not*, of course, supply them in *equal amounts*.

The accompanying table indicates approximately the amounts of the 14 known essential elements in a 100-bushel crop of corn with the accompanying stalks and leaves.

100 bushels of corn (5,600 lbs.) with its stover (6,000 lbs.) contains:

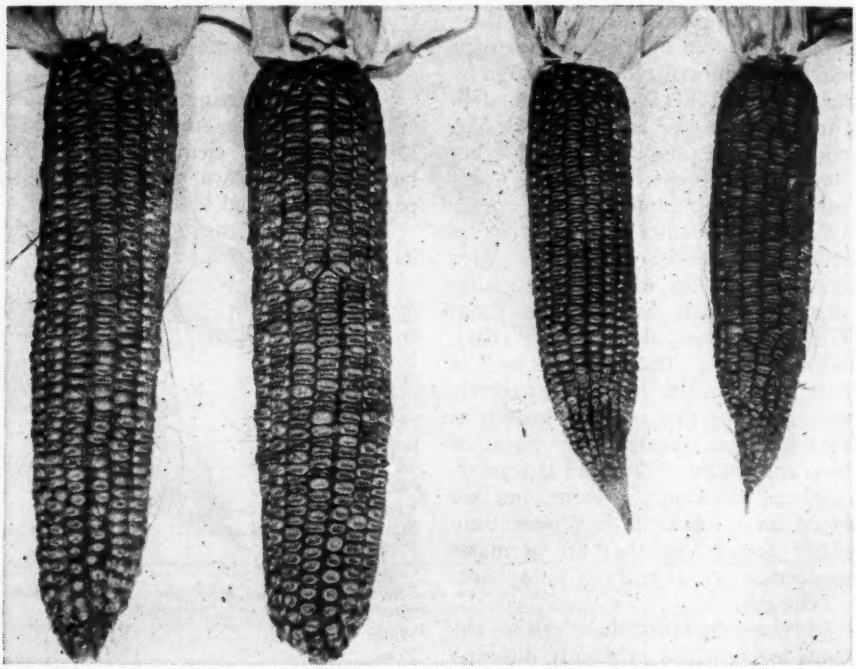
	Pounds
Carbon*–C	5,130
Oxygen*–O	4,560
Nitrogen–N	150
Hydrogen*–H	93
Potassium–K	80
Phosphorus–P	25
Calcium–Ca	22
Sulfur–S	16
Magnesium–Mg	15
Iron–Fe	5
Manganese–Mn	4
Boron–B	0–3 oz.
Copper–Cu	0–1½ oz.
Zinc–Zn	0–1½ oz.
Dry Matter	10,100
Water	1,500
Total	11,600

* Carbon, oxygen, and hydrogen, which the plant obtains from the air and water, amount to 97 per cent of the total weight; the others only 3 per cent. A little of the oxygen comes from the soil in the form of phosphate, HPO_4, nitrate, NO_3, etc.

Phosphorus

In the long slow process of soil formation the weathering of phosphate minerals, together with action of plant roots of the native grass or forest vege-

Left: Corn plants grown out-of-doors in sand cultures (large containers, 10" x 24", 100 lbs. sand), planted 6-5-34 with full, adequate nutrient supply. Center: Same as left except the full, adequate phosphate supply was completly discontinued after the first seven weeks, otherwise complete to the end. Right: Same as center except phosphate supply cut off after five weeks, no normal shoots formed.



Ears to left are from plants receiving nitrogen, phosphate, and potash fertilizer; right, from plants receiving nitrogen and phosphate only. Tapering ears indicate potash deficiency.

tation, released phosphorus, much of which was taken up by these plants and returned to the upper foot or two of soil as part of the organic matter which accumulated through the centuries. This process has gone on so far that today in the dark-colored prairie soils of Illinois from 35 to 60 per cent of the total phosphorus in the plow depth is organic phosphorus. That is, it is part of the organic matter, and is set free for crops as the organic matter decays. Forest soils and the gray prairie contain from 25 to 40 per cent of the total in the organic forms. This is one of the most important forms of soil phosphorus for feeding crops. A century of farming in Illinois, much of it with little or no attention to preserving fertility, has destroyed from a third to half of the virgin soil organic matter, and with it has gone this valuable source of gradually available phosphorus.

The second important phosphorus source for crops is that which has been absorbed by the clay in the soil. That which was released during soil development, which growing plant roots failed to pick up, was stopped by absorption on the clay, so that the rate of loss in drainage water was and is today very slow. This supply absorbed by the clay has also been greatly reduced by hard cropping.

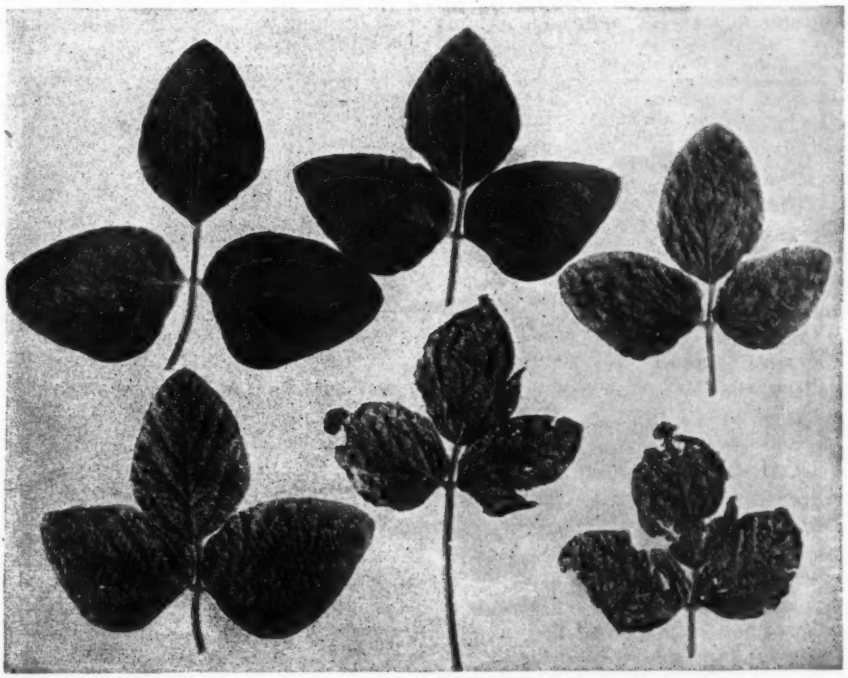
In general, silt loam and clay loam soils, when placed under cropping conditions, become deficient first in phosphorus or phosphorus and nitrogen, and they become deficient in potassium much later. These groups of soils include a large proportion of the land devoted to farming, especially in Illinois and neighboring states.

Recently I visited a farm in central Illinois on Flanigan silt loam, which is slightly rolling brown prairie. It has been just farmed for many years—perhaps you would rather say "mined." It had not grown clover for many years

and the chemical phosphorus test showed no blue color whatever. The potassium test, on the other hand, showed from 200 to 350 pounds an acre. The small yields brought about by exhaustion of the phosphorus and nitrogen reserves in this soil have been too low to encroach seriously on the more abundant native potassium reserves.

The corn on this farm stops growing in June and after a few days a reddish-purple color appears along the central portion of most of the leaves covering the entire width. After a week or 10 days when a few of the leaves have died, the rest regain their normal green color and during the remainder of the season specific symptoms of phosphorus shortage rarely appear.

The main reason for the symptom appearing during the seedling stage of growth is its manner of phosphate "feeding" on the principal forms of soil phosphorus which it must use—organic phosphorus and that absorbed by the clay—and this is true of all plants, not merely corn. Neither form of phosphorus is appreciably water-soluble, nor does it move in the soil. The roots must come to the phosphorus and contact the particles. The available phosphorus supply throughout the soil mass thus becomes honeycombed by the advancing roots while the absorbed phosphorus in the soil between the roots remains virtually intact and undisturbed to the end of the growing season. As a result, only a small percentage of the available phosphorus is removed by a growing crop, and the soil test is nearly as high at the end of the growing season as at the spring planting time. Also, the amount of phosphorus accessible to the plant is proportional to the size of the root system, increasing from almost zero at the seedling stage up to as much as two miles of roots can reach, by spreading through a cubic yard or so of soil, at tasseling time. It is easy now to see why



The foliage of soybean plants deteriorates rapidly when the supply of available potash becomes deficient during the growing season. The leaves first turn yellowish green and become crinkled.

the seedling stage, when the roots contact only a few ounces—maybe even less than one ounce—of soil is the time for severe deficiency symptoms to develop, unless there is a concentration of available phosphorus right at the hill.

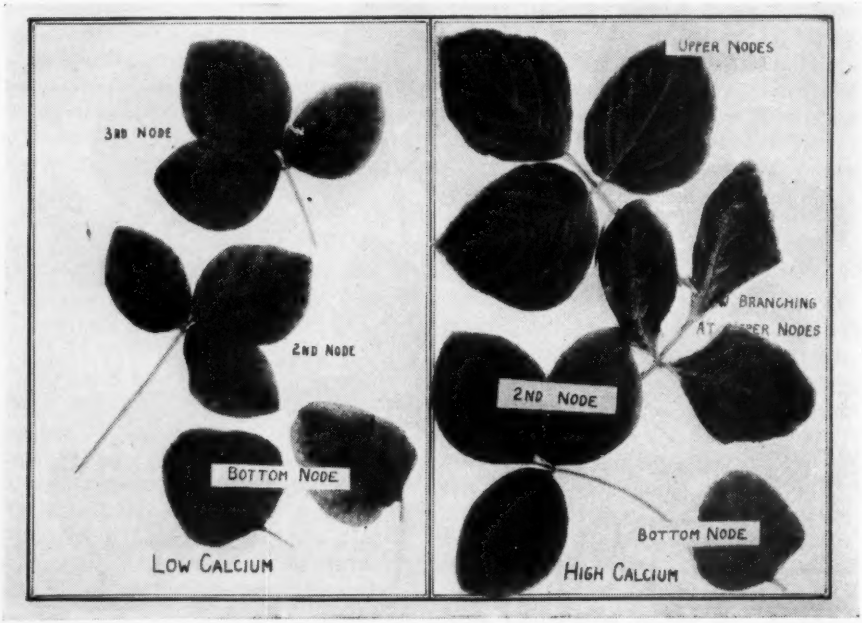
The principal hunger signs in older corn are not easily seen—slow growth, later earing, smaller plant size, and smaller yield of ears in extreme cases.

Aside from a deficient supply of phosphorus in the soil, destruction of corn roots in the seedling stage by insects, principally the grub of the grape colaspis or "clover worm," results in purpling of the leaves. Chemical analysis of the plants shows that this, too, is phosphorus starvation. The phosphorus in these plants is only about half the amount present in healthy corn.

It is difficult to overemphasize the critical importance of the seedling stage of all plants—a time when their root systems are too small for adequate contact with the soil supply of non-movable plant-food materials. Plants stunted as seedlings never recover later and the yields suffer, even though the starvation signs disappear. This is one reason for the benefits from starter fertilizers—small amounts applied by means of attachments on the seed drill or corn planter.

In unusual situations of extreme phosphorus shortage, corn leaves may remain purple long after the seedling stage. This has been observed as late as August in a long-farmed, forest, hill-soil underlain by bedrock at 24 to 30 inches in southern Indiana. Nitrogen was equally deficient and nitrogen hunger signs were equally pronounced along with the phosphorus symptoms on the same plants.

The formation of purple pigment in plants is an inherited characteristic possessed by nearly all lines of corn and many other species of plants. A few inbred lines of corn have been found, such as CC5, whose leaves never become purple. The plant breeders would say these plants have no gene for forming the purple pigment. These



Soybean leaves showing calcium starvation at left; toxicity from super high concentration at right. (Sand culture)

plants show no symptoms in the early stages of phosphorus starvation when they should turn purple. A little later if the shortage continues, the lower leaves turn yellow at the tip and down the middle rib followed after a lag of a week or more by death of the leaf tissue and turning brown. The edges of the leaves stay green longest. This "firing" progresses from the lowest leaves upward and is practically identical with the symptoms of nitrogen starvation; but it is rarely if ever seen in the field because soil phosphorus deficiency rarely becomes severe enough. So you are safe in considering this yellowing and firing in the field as due to lack of nitrogen rather than of phosphorus.

What one sees as symptoms is a reflection of what is happening inside the plant. About half of the phosphorus in a growing plant is in the same simple, water-soluble form as when first taken up from the soil. It is being saved up for the reproductive stage when it will be rushed into the young developing seeds. The other half is changed into the complex organic structure of the living plant cells, chiefly in the nucleus of these cells where indeed many of the most important life processes are started and carried on.

Now when the supply from the soil slows down or stops, the older lower leaves which have already performed a fair share of their purpose in life easily give up their surplus, a soluble phosphorus, which is moved to the growing tip at the top of the plant with no ill effects and no loss of color from these older leaves. But when the soluble phosphorus has all been moved out and the life substance of the leaf itself starts breaking down to give up its phosphorus, the green color of health fades out, the yellow which was there all the time is unmasked so that it is now visible, and soon the leaf dies. However, the growing tip and younger leaves have been kept alive. The plant, though crippled, is still able to function.

A serious crisis may be met when reproduction starts. When the newly fertilized ovules begin to develop into seeds, a larger supply of phosphorus is quickly called for. If the soluble reserve in the leaves and stems has been used up to keep the plant alive and growing, the leaves may yellow and die within a few days, and seed production will be greatly reduced and the quality poor.

I have discussed this one symptom in detail because in understanding this one, we have established some milestones and can pass along with mere mention of variations in our study of other deficiencies.

Before leaving phosphorus you may wish to ask, what about the rich black soils, mostly clay loams, that have never yet needed phosphate additions, and look as though they never will. We merely need to note that these soils were much better endowed than the average with both organic matter and clay, the two great absorbers and preservers of soil phosphorus. They are all vulnerable—some are deficient now, others soon will be, and all of them eventually.

Potassium

In the soil the situation of potassium is in some ways similar to that of phosphorus. It is not able to move through the soil, following water movement, because, like phosphorus it is absorbed on the surface of clay particles so that plant up-take of potassium requires that the roots come in contact with the soil supply. In other words potassium feeding is by root contact and only the film of soil immediately surrounding the roots is denuded of its available potassium, which is perhaps ⅔ as high in the entire root zone at the end as at the start of the growing season.

But the condition of soil potassium differs from that of phosphorus in an important respect. One of the common varieties of soil clay is itself a potassium mineral, and contains potassium atoms throughout its interior much as the printer's ink in a book is distributed in layers between the book leaves, with the marginal spaces partly or wholly

free of potassium, where it has been weathered out by water action, as the marginal spaces in the book are free of printer's ink.

This is the soil reserve from which comes the supply that has maintained the potassium fertility of many soils through a century of cropping. But it will not last forever. It is the widening of those low potassium margins of the clay particles, along with the complete breakdown eventually to ultra-fine clay which is nearly devoid of potassium, which is bringing more acres of Illinois Corn Belt soils into the potassium deficient class every year. Let us examine these different soil areas.

The level grassland and forest soils of southern Illinois have seen exceedingly exhaustive weathering during the ages of soil formation with two definite effects on potassium fertility. The dirt is the long-continued leaching, which, even at a slow rate, eventually removed in drainage waters much of the more available soil potassium. That is, it wore down the potassium supply in the clay particles. During the same time much of the potassium-containing clay was moved down into the subsoil where it formed a tight clay-pan which few roots can penetrate. To be sure, phosphorus, calcium, nitrogen, and possibly magnesium have become deficient, too, and with low balanced fertility, as we have seen, hunger signs are not pronounced, even with 25-bushel corn yields. But when soil improvement is begun by the use of limestone, phosphates, and nitrogen through legumes, but with the neglect of potassium, then potassium hunger signs are quickly brought on, as can be seen on many southern Illinois farms on which the owner has conscientiously carried out the incomplete lime-phosphate-legume program.

Another soil group of typically potassium-deficient soils includes the peats and mucks. These soils are composed almost entirely of organic matter. The potassium in plants is all soluble in water at all stages of growth. It is never, so far as is known, a part of the living tissues of plants. But it is just as necessary as the man on a tractor. He is not a part of the tractor at all, but it does not plow corn without him. Potassium is not a part of the organic tissues of the plant, but the plant cannot live without it. It is now easily seen that as swamp soils were developing, most of the time in water, the potassium was dissolved and washed away. Mucks and peat soils contain only from $\frac{1}{10}$ to less than $\frac{1}{20}$ as much potassium as the adjacent upland soils, and they also lack the clay which if present would greatly retard the loss of the potassium by absorbing it.

(*Turn to page* 46)

Alfalfa shows boron deficiency by a yellow chlorosis affecting first the upper part of the plant. The surest symptom is death of the terminal bud of the main stem and growth of upper branches until they resemble a rosette.

I Saw It Happen in the Soil-Testing Laboratory

By Ivan E. Miles

Soil Testing Division, Department of Agriculture, Raleigh, North Carolina

WITH the enormous amount of soil-testing work being done and the tremendous interest together with the urgency in need for this type of work, it is felt that the workers in this field might profit by swapping observations. This article has been prepared with this in mind. As a basis for these observations, 65,000 samples have been tested in this laboratory during its five years of existence.

Personnel

In the beginning, the laboratory was manned by graduates of an agricultural college, majoring in agronomy or general agriculture. The manpower shortage brought on by the war made it imperative to use girls. Some of these girls were poorly trained in chemistry. However, by careful selection of those who had a sense of the importance of details, and by exercising considerable care and patience in their training, it has been found that they can do very satisfactory work. Actually, they have done so well that it is anticipated that ultimately, even under normal conditions, girl technicians will be used in the laboratory with only one well-trained chemist supervising the work. The supervisor may not have to give more than one-third of his time to this particular phase of the work. Of course, the agronomist will have to classify the soils as to texture and drainage, and make such other notes on the physical characteristics of the soil as deemed necessary. This type of set-up would necessarily require considerable supervision; but the over-all cost is greatly reduced.

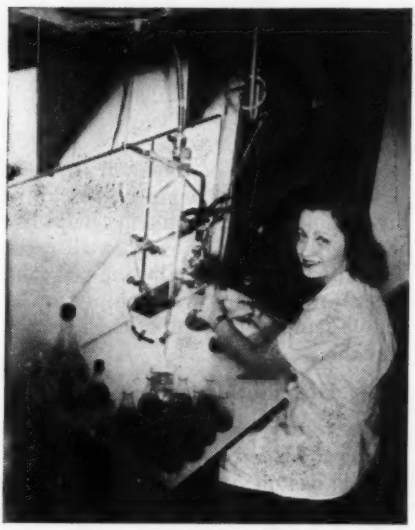


Fig. 1. Girls who have a sense of the importance of details have been trained to do very satisfactory work in the laboratory.

Sampling

Sampling very probably is the weakest link in the whole soil-testing program in North Carolina. The soils of this State vary from the rough stony out-crop of the Appalachian mountains to the muck soils of the coast approaching sea level. Even within a small field —all of the same type—there are tremendous variations. Under the conditions that exist in this State, the procedures set forth for collecting soil samples by the Florida, Kentucky, and Colorado Agricultural Experiment Stations would often result in very poor samples. Eight to 10 sub-sample units, composited into one sample, could easily be very misleading.

There is nothing unusual about the field shown in Fig. 2. In fact, insofar as appearance is concerned, perhaps most fields of the State would be more variable than this one. It is interesting to note that in the 20 samples taken within this field the pH varied from 6.1 in the case of one sample to a pH of 5.1 in the case of another. Furthermore, the extremes in potash and phosphorus varied from high to low. The composite sample gave an intermediate test—with the possible exception of potash, which appeared to be approaching the upper range. The field is probably too large for one sample. The instructions in North Carolina for collecting soil samples designate that, if the field is larger than 10 acres, it should be divided into five-acre units; perhaps five acres will be large enough in all cases. The instructions for collecting soil samples also designate that a minimum of 15 sub-samples be composited to represent the field.

Distribution of Samples

The testing of soils as a basis for the liming and fertilization program naturally has its greatest appeal to the farmer immediately before planting time. When the laboratory was first started, there were tremendous peaks in our work, most of it coming in the late winter and early spring. A much smaller peak came in the fall; and the remainder of the time, the work was fairly light. Obviously, this would make for several problems. More personnel was needed during the peaks of the work than during the remainder of the year; and since the personnel generally had to be trained, this was quite a problem. Furthermore, the farmer usually wants the report upon his soils immediately after submitting them to the laboratory. If he has to wait too long, he loses interest and goes ahead and buys his fertilizer and lime. Considerable effort has been made to show the farmer that, if the sample is taken properly, in most instances it can be collected well ahead of time without very greatly affecting the results of the test. As a result of this effort, together with the recent necessity for buying fertilizer early, the samples are better distributed over the year at the present time. For instance, during the last half of 1945, there were over 8,000 samples tested. This type of distribution enables

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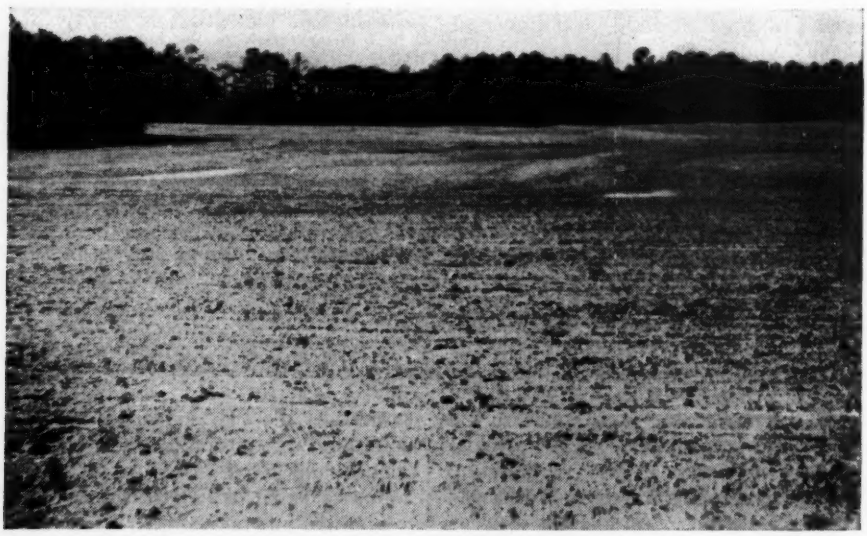

Fig. 2. The field from which 20 samples were collected did not look unusual.

Recipe for Writing the AG News Story

By Marjorie B. Arbour

Agricultural Extension Editor, University of Louisiana, Baton Rouge, Louisiana

THERE'S no surer way for a novice to do a good job than by following a recommended recipe. Old colored mammies and experienced heads might depend on the unreliable system of unmeasured pinches and dashes in making various concoctions, but the inexperienced always does well not to rely too much on ingenuity.

A recipe for writing the ag news story built around this idea, would include the following:

1 quart of WHO
1 cupful of WHAT
1 tablespoonful WHEN
1 teaspoonful WHERE
1 dash of HOW
1 pinch of WHY

Directions: Supply the answer to all these questions. Select the most significant fact in the story with which to start. Mix together in LEAD paragraph and you'll have a synopsis of the event.

"WHO" Adds Tang to the Story

WHO—an important ingredient—is probably one of the most fascinating questions in the English language. Each name carries its own audience. When you start taking your notes, get all the names that figure in the event.

Always identify. Example: John Jones, veterinarian, will help to vaccinate pigs entered in the fall Livestock Show. All members are urged to have their animals at the schoolhouse at 10 o'clock Thursday morning, July 14.

"WHAT" Keeps Story from Falling Flat

Simply to include a WHAT is not sufficient. Make sure that your WHAT

tells the reader just what the story is about. Too often reporters tell only half of the WHAT. For instance: H. C. Lecompte, county agent, gave a demonstration to club members, etc. Giving the demonstration is the WHAT all right, but it doesn't tell specifically WHAT took place. Better to say—How to plant hybrid corn was demonstrated, etc.

Measure "WHEN" with Extra Care

Never fail to get the exact time that figures in the event. If the story is an advance account, (that is, one written before the scheduled event happens), the exact hour plus the day and date should be given. We all look to the paper to check on the WHEN of a coming event. For example: How to write news stories will be explained by J. W. Smith, extension editor, at a meeting of adult and 4-H reporters to be held at the Library Monday afternoon, April 14, at 2 o'clock.

Put in Proper Amount of "WHERE"

In the advance story the WHERE must be more specific than in the follow-up story. Persons planning to take part in the event need the exact information as to WHERE the meeting will be held. Too many stories contain incomplete WHERES. For instance the WHERE is frequently answered this way: How to use electricity economically will be demonstrated on the campus of the State University, etc.

The University campus covers acres. It's an easy matter to kill an hour's time looking for the place of the meeting when it is stated indefinitely. Give the name of the building. Go further and state the name, or number, of the room. To answer the WHERE in the advance story, write it in this manner: How to use electricity economically will be demonstrated by James Hall, engineer, in room 203 in the Engineering Building on the University Campus, Saturday morning, June 26, at 10 o'clock.

"HOW" and "WHY" Like Salt and Pepper

The addition of the HOW and WHY means a better flavor to the story. If the story admits of the use of the HOW, the chance for writing a tastier LEAD is greater. In some stories, however, the HOW is implied, for instance—seldom does the newspaper tell HOW a speech was delivered. If a specialist gives a demonstration on vaccinating a hog and uses a live animal, this addition of the HOW helps the LEAD: Using live hogs in the demonstration, John Smith, county agent, showed a group of farmers how to successfully vaccinate hogs for cholera. The demonstration was held on the Jones farm, June 24.

WHY, as mentioned before, is in the same class with HOW. It is also implied in many LEADS. A LEAD, including the WHY has more flavor. Example: If the ground is fertile it is advisable to use only about five pounds of a standard-grade fertilizer per 100 sq. ft. in gardens, advises Edward Lott, assistant county agent.

Here Lies the Body!

That part of the story which follows the LEAD (the first paragraph) is called the Body. It is composed of details of the main facts mentioned in the LEAD. Just how many paragraphs you devote to the minor facts depends on the importance of the story. Keep paragraphs within 100 words in length. Sentences should not exceed 16-18 words. Always start each paragraph and each sentence with a significant item.

There are many other points that might be stressed in using this recipe for writing the ag story. Try your hand at "cooking up a story." Try and then try again. Remember the first airplane would not fly.

Success will crown your efforts if you'll "keep your fingers in the dough." Keep them there until you're satisfied that the finished product will be well done!

Efficient Fertilizers Needed for Profit in Cotton

By W. L. Nelson

North Carolina Agricultural Experiment Station, Raleigh, North Carolina

COTTON is in the spotlight at the present time. One of the fears which is being expressed for its future is related to its inability to compete with other crops from the standpoint of profits per acre. This phase of the problem demands that we devote our efforts to increasing the efficiency of production of cotton.

There is a reason, or reasons, why a given acre of cotton does not produce two or even three bales of cotton. The weather is perhaps blamed more often than any other one factor. In the Coastal Plain area the boll-weevil damage is the next best excuse presented. Additional reasons are not so specific, however.

The majority of the cotton farmers use adapted cotton varieties, realize the importance of good stands, and in general do a good job of cultivation. The practice of supplying an ample amount of all the nutrients is usually overlooked, however. In observing the growth of cotton in farmers' fields, many evidences of inadequate fertilization are seen. Even then, only the most pronounced deficiencies can be discovered by visual methods.

Some of the general effects of nutrients on yields, obtained the past few years by the North Carolina Agricultural Experiment Station, follow.

Proper Fertilizer Placement

One of the first steps in proper fertilization of cotton is to obtain the maximum efficiency from the nutrients supplied. The results presented in Figure 1 show the importance of band-

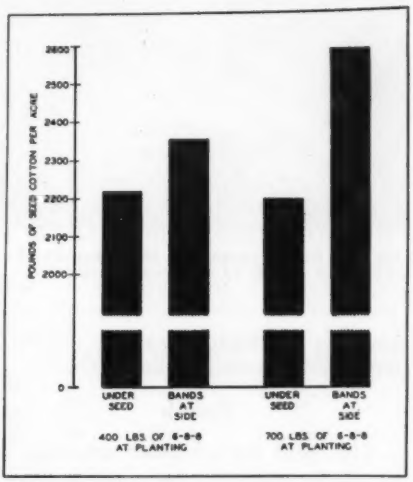

Fig. 1. Band placement makes for more efficient use of high amounts of fertilizer on cotton.

placement of fertilizer in obtaining benefits from greater amounts of fertilizer.[1] With 400 pounds of 6-8-8 at planting band-placement, as compared to under-seed placement, increased the yield of seed cotton 134 pounds per acre. With under-seed placement there was no benefit from higher amounts of fertilizer at planting. With the band method of placement, however, 700 pounds of 6-8-8 gave a substantial increase in yield with an advantage of 393 pounds of seed cotton being obtained.

Hence, if one of the factors limiting yields is an inadequate supply of nutrients, maximum returns from additional

[1]J. J. Skinner, W. L. Nelson and C. W. Whittaker. Effect of salt index, analysis, rate and placement of fertilizer on cotton. J.A.S.A., 37: 677-688. 1945.

Fig. 2. Cotton growth on September 15—left, 60-50-0; right, 60-50-90. The yields were 988 and 1,550 pounds of seed cotton respectively. Norfolk very fine sandy loam (0.04 m.e. exchangeable potash).

amounts of fertilizer can be obtained only with proper placement.

Potash

The need for adequate amounts of potash for cotton has been widely recognized. (See Fig. 2). The removal of potash by cotton is low, as a two-bale crop removes only about six pounds of K_2O in the lint and 22 pounds in the seed. Oftentimes, however, cotton is grown in rotation with crops which remove rather high amounts of potash. The cotton plant is a weak feeder for potash and hence the potash must be supplied directly to the cotton crop.

The importance of the distribution of potash in a cotton-peanut rotation is shown in Figure 3.[2] The experiments were conducted for a period of six years. Direct applications of potash to cotton were more effective than applying part to cotton and part to peanuts. On every soil 48 pounds of K_2O directly on the cotton gave the highest yield. The yields of peanuts were not affected significantly by the potash applications.[3]

In addition to the effect of potash on the production of lint, the effect on the composition and yield of the cotton-seed must be considered. The percentage of oil in the seed was increased from 15.6% with no K_2O (adequate nitrogen) to 18.2% with 60 pounds of K_2O per acre. (See Fig. 4.) With 90 pounds of K_2O (not shown in Figure 4) the oil content was increased to 19.0%. The total amount of oil was increased 60 pounds per acre with 60 pounds of K_2O. The percentage of nitrogen in the seed was decreased by the additions of potash but there was practically no effect on the total amount of nitrogen per acre. (See Fig. 5.) The yields of seed cotton for 0, 30, 60, and 90 pounds of K_2O per acre (with adequate nitrogen) were 1386, 1494, 1751, and 1794 pounds per acre, respectively.

Nitrogen

Of the three major nutrients nitrogen is the nutrient removed in greatest amount in the cotton crop. A two-bale

[2] J. J. Skinner, W. L. Nelson and E. R. Collins. Potash and lime requirements of cotton grown in rotation with peanuts. J.A.S.A., 38: 142-151. 1946.

[3] Colwell, W. E., and Brady, N. C. Soil Fertility studies with peanuts, N. C. Dept. Agr. Bul., Fall 1942-Spring 1943. (Page 54.)

crop of cotton removes 50 pounds of nitrogen in the seed alone and an additional 15 pounds in the lint. The estimated quantity of nitrogen used per acre on cotton in North Carolina in 1943 was 25.6 pounds.[4] This means that on most of the cotton soils sufficient nitrogen was added for about one bale of cotton and that a large share of the cotton was suffering from nitrogen deficiency. Unless the cotton is grown after legumes turned under or on dark soils which will furnish some nitrogen, a two-bale crop cannot be expected.

An average of the data from experiments covering long periods in the fertilizer-using section of the Cotton Belt shows that yields of seed cotton were increased by increments of nitrogen up to 48 pounds per acre.[4] The data for larger applications were not given.

The winner of the 1945 five-acre contest in North Carolina produced 1,416 pounds of lint per acre. He turned under a heavy lespedeza sod in December and applied a total of 800 pounds of 4-10-6 before planting. Two hundred pounds of nitrate of soda were side-dressed. This is a total of 64 pounds of nitrogen per acre in the fertilizer alone.

In addition to the effects of nitrogen on the yield of lint there is an effect on the cottonseed. Sixty pounds of nitrogen per acre, as compared to 35 pounds, decreased the oil content of the cotton-seed but still increased the total amount. (See Fig. 4.) With adequate potash, additions of nitrogen increased the percentage of nitrogen in the seed as well as the total amount. (See Fig. 5.) The yields of seed cotton for 10,

[4]J. J. Skinner. Use of commercial fertilizers in cotton production. U. S. D. A. Circular 726. 1945.

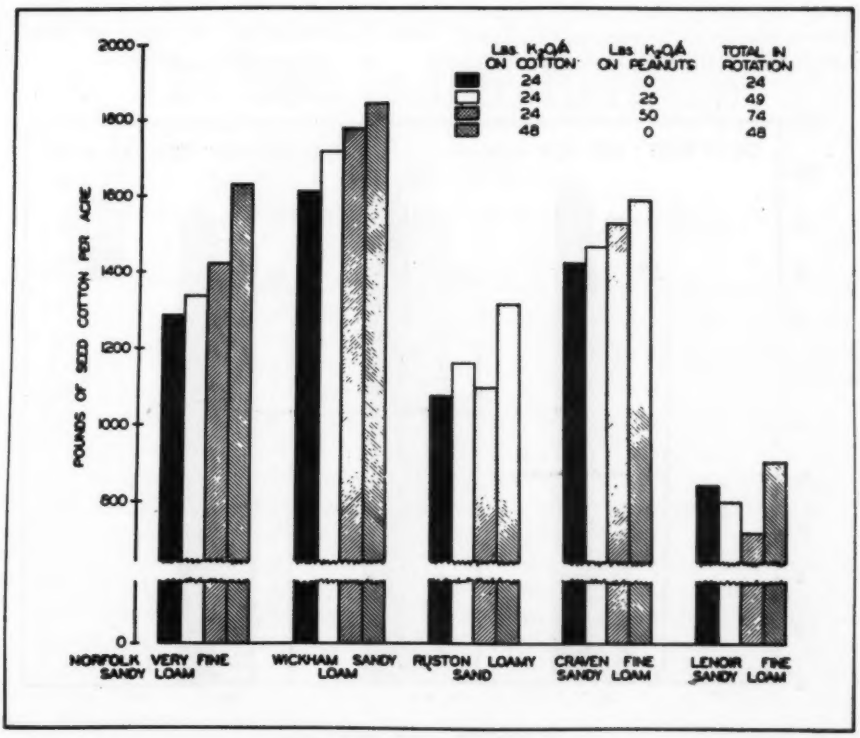

Fig. 3. In a cotton-peanut rotation applying all the potash on the cotton is more effective than applying part on the cotton and part on the peanuts.

35, and 60 pounds of nitrogen per acre (with adequate potash) were 959, 1482, and 1751 pounds per acre, respectively.

One of the reasons for the inadequate nitrogen fertilization of cotton is that the growers, in the Coastal Plain at least, are afraid of too much weed in a severe boll-weevil year. There is probably no one general practice which would do more to start North Carolina cotton yields climbing than a program of boll-weevil control. If the grower knew that he could check the boll-weevil for a few days at the time the cotton plant was setting bolls, he would not be so hesitant to use those practices which would give him more growth.

Phosphate

A two-bale crop of cotton will remove approximately 30 pounds of P_2O_5 in the lint and seed. While the response of cotton to applications of phosphate is related to the content of soluble phosphorus in the soil, phosphate tends to hasten the maturity of the cotton, and responses occur more frequently in years of severe boll-weevil infestation.

The responses from applications of phosphate in some experiments in 1944 and 1945 are shown in Table 1. In the first three experiments, 60 pounds of P_2O_5, as compared to 20 pounds, increased yields at two locations under conditions of severe boll-weevil injury. The soils contained 8 and 43 p.p.m. of soluble P, respectively. The soil at the third location contained 43 p.p.m of P but there was little weevil injury and no yield response.

On Cecil gravelly loam, a Piedmont soil, there was only a trace of soluble P in the soil. (See Table 1.) In 1944 and 1945, 100 pounds of P_2O_5 per acre increased the yields of seed cotton 598 and 883 pounds, respectively. At another location, on Norfolk sandy loam (Table 1), the soil contained 18 p.p.m. In 1944, with little weevil injury, there was practically no response to phos-

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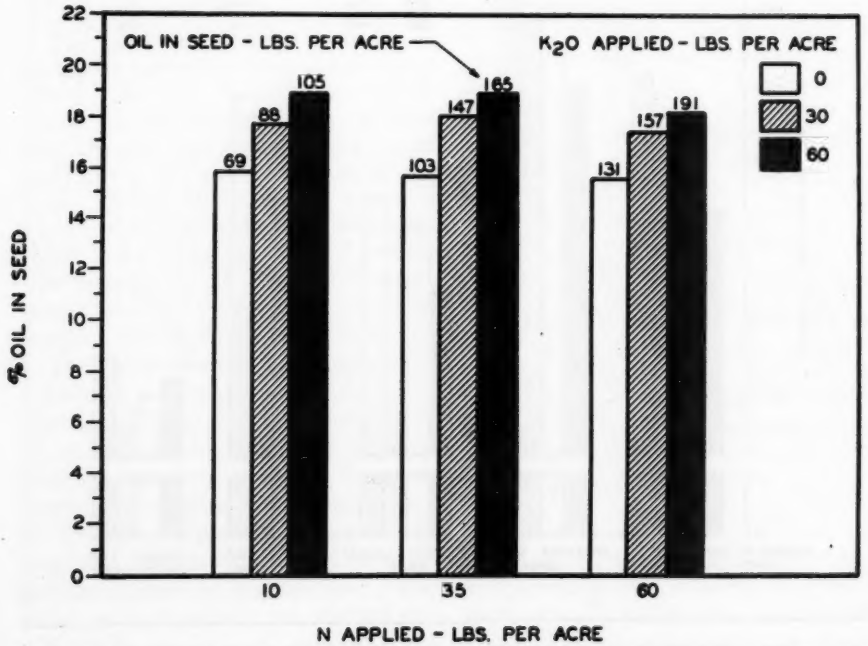


Fig. 4. Under conditions of a response in yield of lint to potash and nitrogen additions, the percentage and total amount of oil in the seed are influenced.

Erosion, ceaseless, devastating, and ugly, keeps knawing away at this gully in a sloping pasture field near the Hardin farm. This is the kind of gully Hardin, King, and Kreider have healed through good plant food, good grass, and good management.

The Soil Is Our Heritage

By Francis Murray

Assistant Extension Editor, Purdue University, Lafayette, Indiana

THERE is an adage about the soil, "You can't take more out of it than you put back." These ancient words of wisdom were respected but not obeyed during the first century of America's road to agricultural progress. Now there is a rising swell of interest in the comparatively new science of feeding the soil. It comes, in many sections, too late, but in others in time for the individuals tilling the soil to become conservation-minded.

Many farmers have found new hope in the wartime upsurge in prices which has enabled them to furnish nourishment for their thin, mineral-hungry soil. This plant food has helped to hold up production, and production with good prices helps buy more plant food. But much of the cropland has lost more plant food than it gained during the recent war years and can never again produce crops in abundance without fertilizers.

How did our land get this way? There are men everywhere who can tell you the story. The history of nearly every farm has a lot in common with every other farm.

Consider, for example, a 96-acre farm in Huntington County, Indiana. Its history, as far as American farming is concerned, started around the days when the Miami Indians roamed the nearby Mississinewa and Wabash river valleys.

White settlers, who pushed across the Ohio territory to stake out what is now

the Hardin farm, found there a great virgin hardwood forest.

The thick undergrowth served as a haven for a multitude of wild fowl and animals. When the foliage tumbled down in autumn it lay where it fell and served as a sponge to retain the water from the melting snow and the spring rains.

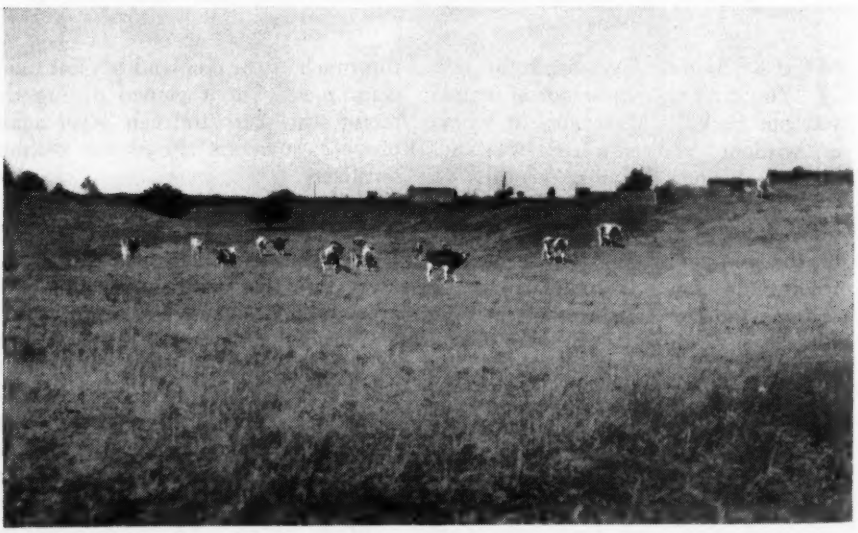
It was a hazardous, tedious, and difficult task the pioneer farmer faced. There was more wood than he needed; more than he knew what to do with. The trees that were long and straight and easily split, he converted into a crude dwelling, rail fences, farming implements, and furniture. But there was much too much timber. The quickest way to clear the land was to hack down the trees in the fall and burn them in the spring. Thus there was room to grow corn and wheat and flax between the stumps.

The topsoil was deep and mellow and rich. The rainfall was abundant, the crops grew quickly, and the harvest was bountiful. Growing the crops, once the land was cleared, was less difficult than processing them, a task that was done largely within the home or the frontier neighborhood. Any surplus crops were hauled away and traded for necessary metal products, sugar, and gunpowder. Most of the other essentials of life were gleaned from the harvest.

From the first year the land on the Hardin farm was cleared the soil was tilled relentlessly. Year in and year out the fields were planted to corn or wheat. In spring it was easier to burn off what remained of last year's vegetation than to plow it under.

When more fields were cleared and when the first generation of frontier children grew to manhood it became necessary to stock the farm with more animal power. Then it required some domestic hay in addition to the volunteer hay to feed the horses in winter. That changed the crop rotation a little, but there was no rest for the soil. The tenant of the land noticed the soil was compacting on the high ground. In dry seasons great clouds of dust arose from the open fields, and the heavy rains made the creeks muddy from the silt that was washing from the cornfields. Little gullies began to appear on the slopes.

Each succeeding generation saw the gullies widen and deepen, and the creeks became muddier each year. The



A few years ago this grassy valley was cut up with gullies "you could bury a horse in," says County Agent Walter Rusk, commenting on the farm. Grass waterways, good fertilization and management have resulted in healing over the gullies.

Hardin and King are shown in the heavy stand of bluegrass that supplies more than abundant pasture for their 30-head of Guernseys. There is always more pasture than the herd needs on the 96-acre farm, but the owner and operator are bent on returning organic matter to the depleted topsoil.

wild game and wild fowl diminished in numbers. Birds that came in great multitudes during the summertime were noticeably fewer; and the insects became increasely numerous and troublesome. Some years they damaged the crops.

The struggle to make a living on the Hardin farm became more and more difficult. Sometimes there were almost total crop failures. It seemed the summers got drier each succeeding year. The soil was noticeably less productive. Some of the fields became so gullied they had to be abandoned to pasture.

By the turn of the present century the Hardin farm was scarcely producing a living for a family of average size. It became necessary to obtain some acreage in addition to the original 80. Sixteen adjoining acres were secured and helped to offset the acres that were being taken out of cultivation.

The operator of the farm decided it might well become a dairy farm. There was the city of Huntington less than five miles away, and the low ground still supported a good stand of pasture grass. Some winter feed could be raised on the tillable high ground.

The dairy venture on the Hardin farm was a partial solution to the problem of making the tired, worn-out soil produce a livelihood. More land might have been obtained but money was "hard to get laid up," and so the next best move was to rent some additional land for growing winter feed for the dairy herd. By now, half the Hardin farm was pasture and of that which remained, little was productive. The little creek went dry each summer. The last bit of woodland was cleared for cropland.

Sam Kreider, who owned the farm before Hardin bought it, had struggled to his death trying to make an honest and decent living; and the farm, as a productive unit in a competitive age, was dying with him. Leonard Kreider, the son, had left the home farm to work in the city because there wasn't a living on the farm for both father and son.

When the elder Kreider died, Leonard came home to continue the problem of getting a living from the farm. It was in the late thirties. Times were extremely difficult. Prices were low, and taxes, set for the farm when it was more prosperous, were high.

Almost hopelessly young Leonard Kreider toiled against seemingly insurmountable odds in an effort to keep the

home place producing, producing at least a living for himself and his widowed mother.

The county agricultural agent told him that if he could apply some lime to the soil and get sweet clover started it might build up the ground and at the same time the sweet clover would make pretty good dairy roughage. It was worth trying, but the farm income wouldn't stand much of a cash outlay for lime. The young farmer discovered the operator of a limestone crusher nearby who would give away the pulverized portion of the stone for the hauling since it was unfit for road surfacing. Kreider hauled the refuse lime to his farm by team and wagon and shovelled it onto the soil. Every acre, pasture land and cropland, was coated with lime.

The lime made the sweet clover grow. When the sweet clover was turned under, the corn crop that had gotten down in production to less than 25 bushels per acre began to increase accordingly.

The county agent, impressed with the sincere efforts young Kreider made to restore the old farm to productivity, recommended the farm to Purdue University as one of a group throughout the State which were being selected as test demonstration farms, in a project sponsored jointly by The Tennessee Valley Authority and the University.

The University, in an effort to find practical and profitable means for restoring lost fertility to the various types of soil in the State, had a plan whereby the farm operator was offered the technical services of the University in return for his cooperation in carrying out subsequent suggestions which included modern soil conservation and restoration practices. Under the plan, the financial returns of the farm were entirely in the hands of the operator although he was required to keep an account of costs and profits for comparison.

The farm was to remain as a dairy farm, but some of the fields were to be rearranged. The rented acreage in addition to the Kreider farm was not to be affected but was to be used for growing additional corn for winter feed.

Kreider went into the plan with whole-hearted enthusiasm. He filled in gullies and sowed them to grass. Grass

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The house on the Hardin farm is occupied by operator Marvin King. Along with the farm the house, too, is getting its face lifted. New landscaping, a new heating plant, and other modern conveniences are being installed. In an ideal owner-operator relationship, King goes ahead with the improvements. He is shown here preparing to rebuild the front porch.

Corn Production In Mississippi

By J. M. Weeks

Department of Agronomy, Mississippi State College, State College, Miss.

APPROXIMATELY 2⅔ million acres of corn and a half million acres of oats and other small grains are planted in Mississippi each year. The low average yield of 15 bushels of corn and 30 bushels of oats to the acre produce only 65 to 70 per cent of the grain needed for feeding the number of livestock now on farms. The State has always been a deficient feed-producing area, along with other southeastern states, and the number of grain-consuming animals is steadily increasing.

Corn has been a "stepchild" in its treatment compared with the cash crop, cotton. Probably 90 per cent of the cotton acreage receives reasonably high rates of recommended fertilizer, while not more than 10 per cent of the corn receives any fertilizer at all. This difference in treatment cannot be justified on a basis of difference in returns from the dollar spent for fertilizer for the two crops.

Corn experiments in Mississippi for more than 20 years have shown that nitrogen, in all sections of the State, returns four to five dollars worth of corn for each dollar spent for fertilizer used on it. This is about the same rate of returns as received from fertilizer used on cotton.

The yield of corn could be increased from the 15-bushel average to 25 bushels if each acre was fertilized with 24 to 32 pounds of nitrogen. This would mean an increase of 26 million bushels of corn from the 2.6 million acres in prospect for 1946. At present high prices, the increased corn would be worth 39 million dollars. The total corn production would be a record crop of 65 million bushels, worth 97½ million dollars.

Junior Merle Hester, Iuka, Mississippi, grew 130½ bushels of corn per acre in 1945.

This quantity of corn and the 15 million bushels of oats should satisfy the grain requirements of the livestock in the State.

While 24 to 32 pounds of nitrogen per acre are generally recommended, there is evidence that many very poor hill soils need phosphorus and potash also for growing high yields of corn. Other states in the Southeast have published record yields of corn produced on poor land from heavy applications of complete fertilizer. These tests and demonstrations are pointing out possibilities of corn production through a balanced fertilizer program which is gaining attention and support of agricultural workers and leading farmers.

Special corn-production demonstrations were started in Mississippi in the late spring of 1945 with 4-H Club boys. The demonstration program was expanded in 1946 to include adult farmers and larger numbers of 4-H Club members. The American Potash Institute sponsored the special 4-H corn-production contest in cooperation with the Mississippi Extension Agronomy Department and participating county and assistant county agents. A total of 109 4-H boys conducted corn demonstrations in 1945. Complete records were obtained on 23 demonstrations which were in competition for awards offered in the contest. Eight widely scattered counties were represented.

Fertilizer requirements in the demonstrations follow:

HILL SECTIONS OF STATE AND FOOTHILLS OF DELTA

Plot	Treatment	Rate per Acre
1	6–8–8 fertilizer	500 lbs. (applied in water furrow before bedding rows for planting)
	Additional nitrogen	32 lbs. nitrogen side-dressed when corn is about knee high
2	Nitrogen only	32 lbs. nitrogen in water furrow
	Additional nitrogen	32 lbs. side-dressed
3	Check—no fertilizer used	

Fertilizer in plots 1 and 2 was applied in the water furrow before the land was bedded for planting. These two plots also received a side-dressing of 32 pounds of additional nitrogen when the corn was about knee high.

Corn yields were estimated in the field according to a standard method and were finally corrected to a basis of dry corn after storage and drying.

The location, soil, fertilizer treatment, and yields per acre on these reported demonstrations are shown on page 45.

The average yield of the check plots, without fertilizer, was 47 bushels per acre. Since the State average yield in 1945 was 20 bushels per acre, the soils on which the demonstrations were conducted were generally better than average.

Average yield on No. 2 plots, receiving 64 pounds of nitrogen per acre, was 61 bushels, or 14 bushels more than the corn which was not fertilized.

Plots No. 1, which received the same amount of nitrogen as plots No. 2 and also phosphorus and potash, averaged 78 bushels. This yield was an increase of 17 bushels per acre which can be credited to the phosphorus and potash, and this corn which received complete fertilizer and high rate of nitrogen averaged 31 bushels more corn to the acre than the 47-bushel yield from the unfertilized corn.

Five of these club boys produced more than 100 bushels to the acre. The highest yield was 130½ bushels per acre, produced by Junior Merle Hester of Iuka, Tishomingo County. He grew 118⅔ bushels per acre on the same land in 1944.

As Junior Merle told it in the newspapers, and in Chicago last December at the National Livestock Show, here's how he produced the bumper corn yield:

"With the help of T. K. Marlin and S. P. Dent, assistant county agents, and other members of the extension staff, I went all out for 4-H Club work. Due to a wet spring, I got off to a late start. I cleared up my ground May 18 and got it disked and ready for planting by June 1.

"I planted my corn June 1, using 200 pounds of soda to the acre on one plot and then I planted five rows without any fertilizer. On the other part of the acre I used 500 pounds of 6-8-8 to the acre. When the corn got about six inches high, it began raining. It was June 22 before I got to work it out. The grass was about three inches high and the ground was muddy, but I muddied through it.

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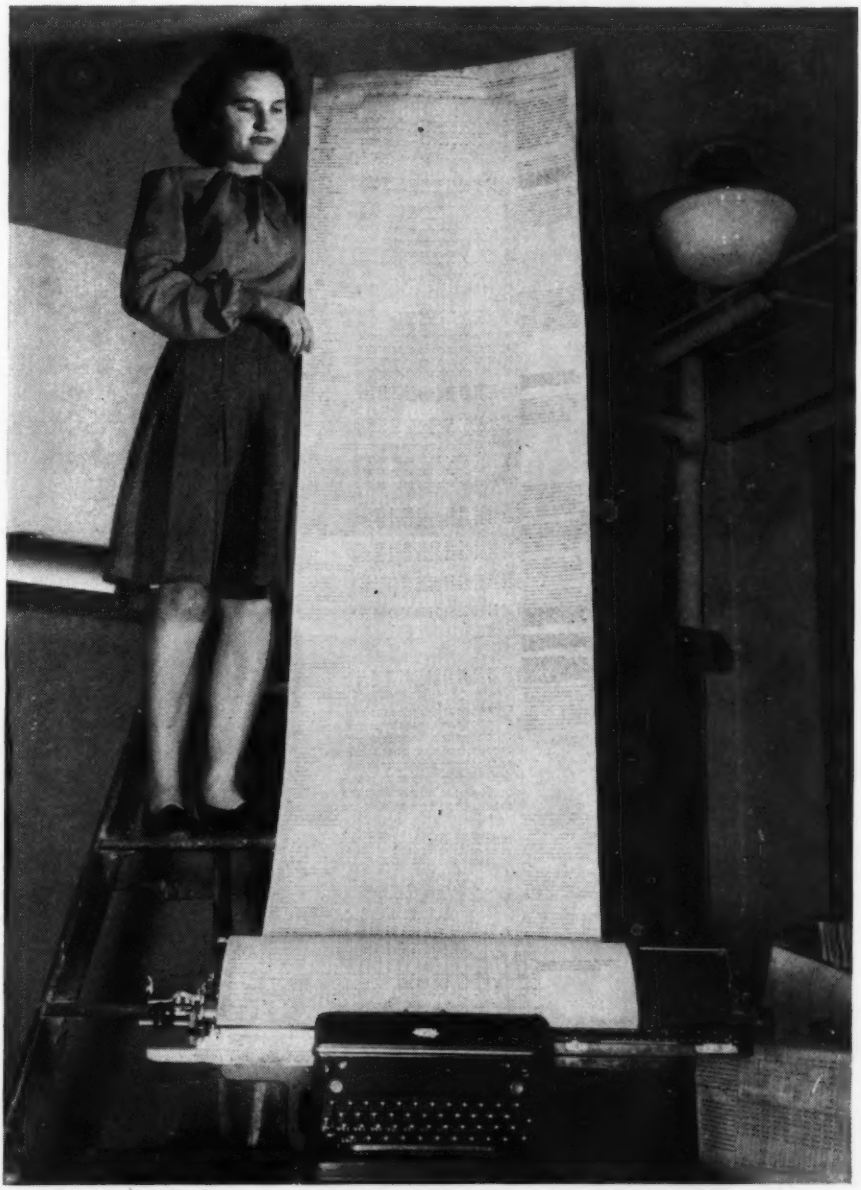
PICTORIAL



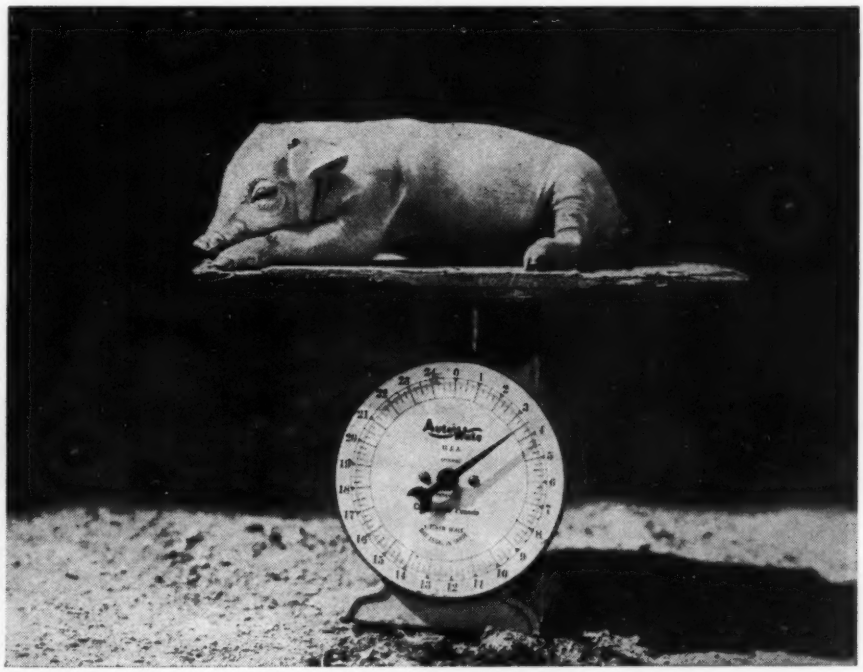
Miss Opal Marcus of the Bureau of Plant Industry, Soils, and Agricultural Engineering, Beltsville, Md., exhibits a chart she has just typed showing "Productivity Ratings of the Soils in St. Joseph County, Indiana." The chart shows that a soil survey often covers a lot of ground and many different kinds of it. This one shows the productivity of 113 soil types for 13 crops, but some soil survey reports have covered more than twice as many types. That is one reason why where soil surveys have been made farmers can get accurate information about the land right under their feet.

Above: Ice-cream "time" is just around the corner.

Below: Filling the hopper with food for corn.

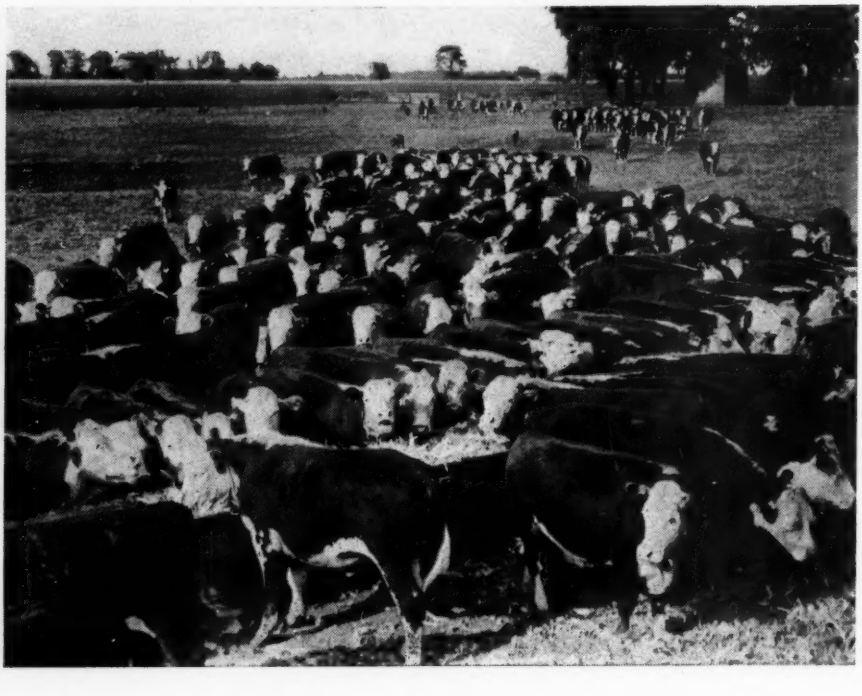
Above: Well-guarded against any over-all attack.

Below: Will he ever catch up with his litter?



Above: The beginning of some good steaks.

Below: The finishing of some good steaks.



The Editors Talk

Starvation in America

The eyes of the world are turned to America to relieve the starving peoples of the war-devastated countries. Our bounty is well known and from our stocks now, every effort is being put forth to meet the dire needs of these peoples. At the same time, fortunately, our agriculturists are not lessening their concern that our soils be so managed as to meet these additional drains being put upon them and still produce in abundance and variety for the demands of our standard of living.

Dr. George D. Scarseth of the American Farm Research Association is to be credited with some cogent statements in this respect. "If the plants in our fields and pastures could cry out whenever they were starving for elements that nourish them, the noise coming from some fields," he says, "would be enough to give the strongest mind a headache. If the noise were in proportion to the extent of the starvation, there are really only a very few fields throughout the humid agricultural area of America that would be so contented that no sound would be heard."

He goes on to say that plants, of course, cannot express themselves through sound but that they have another means equally eloquent for expressing their needs. When plants starve for a nutrient element some characteristic symptoms usually develop. These symptoms are popularly called "hunger signs." The details of these hunger signs are numerous; however, every grower of crops will benefit by becoming acquainted with them.

Dr. Scarseth points to the startling fact that on about 33,000,000 acres of corn in the U. S. A., which is about 43 per cent of the total acres in corn, the average corn yields are down to only 12 to 20 bushels per acre. When the yield is this low it means that the farmer is going backwards financially and also probably in health. It means that on all these millions of acres of impoverished land millions of bushels of corn are being produced that have come from starved plants. It means that the farmer and his family on millions of acres work for nothing as far as any net cash returns are concerned. From studies of farm records it has been pointed out that it costs from $12 to $18 per acre to produce and harvest a corn crop, thus if the yield is in similar figures the cost per bushel is about $1.00. It is not often that the price of corn has been above $1.00 per bushel.

"It is difficult," Dr. Scarseth says, "to see how there can be great agricultural prosperity even if prices for farm commodities were good, as long as the productivity of the different acres is so low that the cost per bushel or ton or bale is high because of the very fact that the yield is low. It appears that farming methods must become more efficient on the basis of producing our bushels of corn and grain, our bales of cotton, our tons of hay, or our gallons of milk at lower costs per units by producing more per acre and by using fewer acres.

"In the past we have made the error of looking at the gross bulk of crops produced in the Nation and have feared overproduction if any methods for increasing the yield per acre were strongly advocated. We have tended to overlook that too frequently much of this production occurred from plants growing on impoverished soils, showing the hunger signs of various degrees of imperfection from malnutrition, and on top of all this the farmers have been compelled to produce many of the crops uneconomically. If the plants of our fields and pastures could only cry good and loud when they are starving or if they could cry 'we are producing uneconomic crop units' we would sooner recognize some of the real basic problems confronting us.

"The scientific technology exists for making almost any acre produce economic units of crops free from hunger signs and producing food materials that come from healthy plants. This will mean growing our gross total of crops on fewer acres but more economically on the acres used. This would release much land for a better land use with respect to the conservation of the soils on lands that are easily eroded. If we are to utilize these technologies amongst the 6,000,000 farmers of America, a *tremendous problem of widespread education* confronts us. Merely to throw fertilizers on the land is not enough. Crop rotations must be planned in such a manner that vital organic matter is provided as well as the nutrients that grow to make organic matter."

Dr. Scarseth concluded his remarks with: "The problem then that confronts us because of the hunger cries from the fields is vital to all Americans, not just those living on the land. It becomes of indirect concern to all consumers of food materials. The Nation cannot be abundant unless our fields are abundant and our fields cannot be abundant with starvation symptoms in crops more prevalent than non-starved crops."

Rightly stressed is his emphasis on the *tremendous problem of widespread education* which is confronting us. In that connection, we wish to call particular attention to the article by Dr. E. E. DeTurk of the University of Illinois entitled "Learn Hunger Signs in Crops." As Dr. DeTurk points out—The job is not done. In far too many cases our reply has been "We do not know."

Rural Life Conference

"Rural Life in a Changing World" is the fitting theme of the conference of the American Country Life Association to be held at Michigan State College, East Lansing, Michigan, June 11-13. At no time probably, since the formation of the Association in 1919 has its conference had more significance. Not only are there many internal problems such as attracting our farm youth to the farms and rehabilitating men who have been in service, but the world is now counting on American agriculture as a big factor in winning the peace.

Dr. D. E. Lindstrom, Professor of Rural Sociology at the University of Illinois is President of the Association. He has outlined topics covering four phases of rural living as the basis for the three-day conference. These include: Number of people in rural life; religious and moral foundations for rural life; public relations programs for agriculture; and rural community and international relations. Subtopics will be considered under each of these principal items.

The Association encourages many types of rural life programs at state and local levels. It seeks to learn through public forums what rural people are doing and can do through their independent organizations and through their agricultural and educational agencies. The findings of this year's conference will be eagerly awaited.

Season Average Prices Received by Farmers for Specified Commodities *

Crop Year	Cotton Cents per lb.	Tobacco Cents per lb.	Potatoes Cents per bu.	Sweet Potatoes Cents per bu.	Corn Cents per bu.	Wheat Cents per bu.	Hay Dollars per ton	Cottonseed Dollars per ton	Truck Crops
	Aug.-July	.....	July-June	July-June	Oct.-Sept.	July-June	July-June	July-June	....
Av. Aug. 1909–July 1914....	12.4	10.0	69.7	87.8	64.2	88.4	11.87	22.55	....
1920.....	15.9	17.3	125.3	141.7	61.8	182.6	16.46	25.65	....
1921.....	17.0	19.5	113.3	113.1	52.3	103.0	11.63	29.14	....
1922.....	22.9	22.8	65.9	100.4	74.5	96.6	11.64	30.42	....
1923.....	28.7	19.0	92.5	120.6	82.5	92.6	13.08	41.23	....
1924.....	22.9	19.0	68.6	149.6	106.3	124.7	12.66	33.25	....
1925.....	19.6	16.8	170.5	165.1	69.9	143.7	12.77	31.59	....
1926.....	12.5	17.9	131.4	117.4	74.5	121.7	13.24	22.04	....
1927.....	20.2	20.7	101.9	109.0	85.0	119.0	10.29	34.83	....
1928.....	18.0	20.0	53.2	118.0	84.0	99.8	11.22	34.17	....
1929.....	16.8	18.3	131.6	117.1	79.9	103.6	10.90	30.92	....
1930.....	9.5	12.8	91.2	108.1	59.8	67.1	11.06	22.04	....
1931.....	5.7	8.2	46.0	72.6	32.0	39.0	8.69	8.97	....
1932.....	6.5	10.5	38.0	54.2	31.9	38.2	6.20	10.33	....
1933.....	10.2	13.0	82.4	69.4	52.2	74.4	8.09	12.88	....
1934.....	12.4	21.3	44.6	79.8	81.5	84.8	13.20	33.00	....
1935.....	11.1	18.4	59.3	70.3	65.5	83.2	7.52	30.54	....
1936.....	12.4	23.6	114.2	92.9	104.4	102.5	11.20	33.36	....
1937.....	8.4	20.4	52.9	82.0	51.8	96.2	8.74	19.51	....
1938.....	8.6	19.6	55.7	73.0	48.6	56.2	6.78	21.79	....
1939.....	9.1	15.4	69.7	74.9	56.8	69.1	7.94	21.17	....
1940.....	9.9	16.0	54.1	85.5	61.8	68.2	7.58	21.73	....
1941.....	17.0	26.4	80.7	94.0	75.1	94.5	9.67	47.65	....
1942.....	19.0	36.9	117.0	119.0	91.7	109.8	10.80	45.61	....
1943.....	19.9	40.5	131.0	204.0	112.0	136.0	14.80	52.10	....
1944.....	20.7	40.8	149.0	192.0	109.0	141.0	16.40	52.70	....
1945									
April.....	20.20	21.4	174.0	211.0	107.0	149.0	16.90	51.90	....
May.....	20.51	42.2	177.0	214.0	108.0	149.0	16.50	52.10	....
June.....	20.90	51.2	180.0	220.0	111.0	150.0	15.90	52.50	....
July.....	21.25	56.3	183.0	230.0	112.0	146.0	15.40	55.00	....
August.....	21.33	44.9	167.0	256.0	113.0	145.0	14.60	52.50	....
September...	21.72	43.2	138.0	207.0	112.0	145.0	14.30	51.40	....
October.....	22.30	45.9	126.0	180.0	113.0	151.0	14.30	51.00	....
November...	22.52	46.7	131.0	186.0	111.0	153.0	14.90	51.30	....
December....	22.84	43.8	137.0	194.0	109.0	154.0	15.40	51.40	....
1946									
January.....	22.36	36.3	145.0	208.0	110.0	154.0	15.70	50.90	....
February.....	23.01	33.9	146.0	223.0	111.0	155.0	15.80	50.30	....
March.....	22.70	31.9	157.0	236.0	114.0	158.0	16.30	47.50	....
April.....	23.59	42.9	162.0	245.0	116.0	158 0	15.00	48.00	....
Index Numbers (Aug. 1909—July 1914 = 100)									
1920.....	128	173	180	161	96	207	139	114	....
1921.....	137	195	163	129	81	117	98	129	....
1922.....	185	228	95	114	116	109	98	135	....
1923.....	231	190	133	137	129	105	110	183	....
1924.....	185	190	98	170	166	141	107	147	143
1925.....	158	168	245	188	109	163	108	140	143
1926.....	101	179	189	134	116	138	112	98	139
1927.....	163	207	146	124	132	135	87	154	127
1928.....	145	200	76	134	131	113	95	152	154
1929.....	135	183	189	133	124	117	92	137	137
1930.....	77	128	131	123	93	76	93	98	129
1931.....	46	82	66	83	50	44	73	40	115
1932.....	52	105	55	62	50	43	52	46	102
1933.....	82	130	118	79	81	84	68	57	91
1934.....	100	213	64	91	127	96	111	146	95
1935.....	90	184	85	80	102	94	63	135	119
1936.....	100	236	164	106	163	116	94	148	104
1937.....	68	204	76	93	81	109	74	87	110
1938.....	69	196	80	83	76	64	57	97	88
1939.....	73	154	100	85	88	78	67	94	91
1940.....	80	160	78	97	96	77	64	96	111
1941.....	137	264	116	107	117	107	81	211	129
1942.....	153	369	168	136	143	124	91	202	163
1943.....	160	405	188	232	174	154	125	231	245
1944.....	167	408	214	219	170	160	138	234	212
1945									
April.....	163	214	250	240	167	169	142	230	259
May.....	165	422	254	244	168	169	139	231	193
June.....	169	512	258	251	173	170	134	233	269
July.....	171	563	263	262	174	165	130	244	244
August.....	172	449	240	292	176	164	123	233	240
September...	175	432	198	236	174	164	120	228	159
October.....	180	459	181	205	176	171	120	226	181
November....	182	467	188	212	173	173	126	227	235
December....	184	438	197	221	170	174	130	228	223
1946									
January.....	180	363	208	237	171	174	132	226	249
February.....	186	339	209	254	173	175	133	223	275
March.....	183	319	225	269	178	179	137	211	283
April.....	190	429	232	279	181	179	126	213	282

Wholesale Prices of Ammoniates

	Nitrate of soda per unit N bulk	Sulphate of ammonia bulk per unit N	Cottonseed meal S. E. Mills per unit N	Fish scrap, dried 11–12% ammonia, 15% bone phosphate, f.o.b. factory, bulk per unit N	Fish scrap, wet acidulated 6% ammonia, 3% bone phosphate, f.o.b. factory, bulk per unit N	Tankage 11% ammonia, 15% bone phosphate, f.o.b. Chicago, bulk, per unit N	High grade ground blood, 16–17% ammonia Chicago, bulk, per unit N
1910–14	$2.68	$2.85	$3.50	$3.53	$3.05	$3.37	$3.52
1922	3.04	2.58	6.07	4.66	3.54	4.75	4.99
1923	3.02	2.90	6.19	4.83	4.25	4.59	5.16
1924	2.99	2.44	5.87	5.02	4.41	3.60	4.25
1925	3.11	2.47	5.41	5.34	4.70	3.97	4.75
1926	3.06	2.41	4.40	4.95	4.15	4.36	4.90
1927	3.01	2.26	5.07	5.87	4.35	4.32	5.70
1928	2.67	2.30	7.06	6.63	5.28	4.92	6.00
1929	2.57	2.04	5.64	5.00	4.69	4.61	5.72
1930	2.47	1.81	4.78	4.96	4.15	3.79	4.58
1931	2.34	1.46	3.10	3.95	3.33	2.11	.46
1932	1.87	1.04	2.18	2.18	1.82	1.21	1.36
1933	1.52	1.12	2.95	2.86	2.58	2.06	2.46
1934	1.52	1.20	4.46	3.15	2.84	2.67	3.27
1935	1.47	1.15	4.59	3.10	2.65	3.06	3.65
1936	1.53	1.23	4.17	3.42	2.67	3.58	4.25
1937	1.63	1.32	4.91	4.66	3.65	4.04	4.80
1938	1.69	1.38	3.69	3.76	3.17	3.15	3.53
1939	1.69	1.35	4.02	4.41	3.12	3.87	3.90
1940	1.69	1.36	4.64	4.36	3.35	3.33	3.39
1941	1.69	1.41	5.50	5.32	3.27	3.76	4.43
1942	1.74	1.41	6.11	5.77	3.34	5.04	6.76
1943	1.75	1.42	6.30	5.77	3.34	4.86	6.62
1944	1.75	1.42	7.68	5.77	3.34	4.86	6.71
1945							
April	1.75	1.42	7.81	5.77	3.34	4.86	6.71
May	1.75	1.42	7.81	5.77	3.34	4.86	6.71
June	1.75	1.42	7.81	5.77	3.34	4.86	6.71
July	1.75	1.42	7.81	5.77	3.34	4.86	6.71
August	1.75	1.42	7.81	5.77	3.34	4.86	6.71
September	1.75	1.42	7.81	5.77	3.34	4.86	6.71
October	1.75	1.42	7.81	5.77	3.34	4.86	6.71
November	1.75	1.42	7.81	5.77	3.34	4.86	6.71
December	1.75	1.42	7.81	5.77	3.34	4.86	6.71
1946							
January	1.75	1.42	7.81	5.77	3.34	4.86	6.71
February	1.75	1.42	7.81	5.77	3.34	4.86	6.71
March	1.75	1.42	7.81	5.77	3.34	4.86	6.71
April	1.75	1.42	7.81	5.77	3.34	4.86	6.71
Index Numbers (1910-14 = 100)							
1922	113	90	173	132	117	140	142
1923	112	102	177	137	140	136	147
1924	111	86	168	142	145	107	121
1925	115	87	155	151	155	117	135
1926	113	84	126	140	146	129	139
1927	112	79	145	166	143	128	162
1938	100	81	202	188	173	146	170
1929	96	72	161	142	154	137	162
1930	92	64	137	141	136	12	130
1931	88	51	89	112	109	63	70
1932	71	36	62	62	60	36	39
1933	59	39	84	81	85	97	71
1934	59	42	127	89	93	79	93
1935	57	40	131	88	87	91	104
1936	59	43	119	97	89	106	131
1937	61	46	140	132	120	120	122
1938	63	48	105	106	104	93	100
1939	63	47	115	125	102	115	111
1940	63	48	133	124	110	99	96
1941	63	49	157	151	107	112	126
1942	65	49	175	163	110	150	192
1943	65	50	180	163	110	144	189
1944	65	50	219	163	110	144	191
1945							
April	65	50	223	163	110	144	191
May	65	50	223	163	110	144	191
June	65	50	223	163	110	144	191
July	65	50	223	163	110	144	191
August	65	50	223	163	110	144	191
September	65	50	223	163	110	144	191
October	65	50	223	163	110	144	191
November	65	50	223	163	110	144	191
December	65	50	223	163	110	144	191
1946							
January	65	50	223	163	110	144	191
February	65	50	223	163	110	144	191
March	65	50	223	163	110	144	191
April	65	50	223	163	110	144	191

Wholesale Prices of Phosphates and Potash **

	Superphosphate Baltimore, per unit	Florida land pebble 68% f.o.b. mines, bulk, per ton	Tennessee phosphate rock, 75% f.o.b. mines, bulk, per ton	Muriate of potash bulk, per unit, c.i.f. Atlantic and Gulf ports	Sulphate of potash in bags, per unit, c.i.f. Atlantic and Gulf ports	Sulphate of potash magnesia, per ton, c.i.f. Atlantic and Gulf ports	Manure salts bulk, per unit, c.i.f. Atlantic and Gulf ports[1]	Kainit, 20% bulk, per unit, c.i.f. Atlantic and Gulf ports
1910–14	$0.536	$3.61	$4.88	$0.714	$0.953	$24.18	$0.657	$0.655
1922	.566	3.12	6.90	.632	.904	23.87	....	.508
1923	.550	3.08	7.50	.588	.836	23.32	....	.474
1924	.502	2.31	6.60	.582	.860	23.72	....	.472
1925	.600	2.44	6.16	.584	.860	23.72	....	.483
1926	.598	3.20	5.57	.596	.854	23.58	.537	.524
1927	.525	3.09	5.50	.646	.924	25.55	.586	.581
1928	.580	3.12	5.50	.669	.957	26.46	.607	.602
1929	.609	3.18	5.50	.672	.962	26.59	.610	.605
1930	.542	3.18	5.50	.681	.973	26.92	.618	.612
1931	.485	3.18	5.50	.681	.973	26.92	.618	.612
1932	.458	3.18	5.50	.681	.963	26.90	.618	.591
1933	.434	3.11	5.50	.662	.864	25.10	.601	.565
1934	.487	3.14	5.67	.486	.751	22.49	.483	.471
1935	.492	3.30	5.69	.415	.684	21.44	.444	.488
1936	.476	1.85	5.50	.464	.708	22.94	.505	.560
1937	.510	1.85	5.50	.508	.757	24.70	.556	.607
1938	.492	1.85	5.50	.523	.774	15.17	.572	.623
1939	.478	1.90	5.50	.521	.751	24.52	.570	.670
1940	.516	1.90	5.50	.517	.730	24.75	.573	....
1941	.547	1.94	5.64	.522	.780	25.55	.570	....
1942	.600	2.13	6.29	.522	.810	25.74	.205	....
1943	.631	2.00	5.93	.522	.786	25.35	.195	....
1944	.645	2.10	6.10	.522	.777	25.35	.195	....
1945								
April	.650	2.20	6.20	.535	.797	26.00	.200	....
May	.650	2.20	6.20	.535	.797	26.00	.200	....
June	.650	2.20	6.20	.471	.701	22.88	.176	....
July	.650	2.20	6.20	.503	.749	24.44	.188	....
August	.650	2.20	6.20	.503	.749	24.44	.188	....
September	.650	2.20	6.20	.503	.749	24.44	.188	....
October	.650	2.20	6.28	.535	.797	26.00	.200	....
November	.650	2.20	6.40	.535	.797	26.00	.200	....
December	.650	2.20	6.40	.535	.797	26.00	.200	....
1946								
January	.650	2.20	6.40	.535	.797	26.00	.200	....
February	.650	2.20	6.40	.535	.797	26.00	.200	....
March	.650	2.20	6.40	.535	.797	26.00	.200	....
April	.650	2.20	6.40	.535	.797	26.00	.200	....
Index Numbers (1910-14 = 100)								
1922	106	87	141	89	95	99	....	78
1923	103	85	154	82	88	96	....	72
1924	94	64	135	82	90	98	....	72
1925	110	68	126	82	90	98	....	74
1926	112	88	114	83	90	98	82	80
1927	100	86	113	90	97	106	89	89
1928	108	86	113	94	100	109	92	92
1929	114	88	113	94	101	110	93	92
1930	101	88	113	95	102	111	94	93
1931	90	88	113	95	102	111	94	93
1932	85	88	113	95	101	111	94	90
1933	81	86	113	93	91	104	91	86
1934	91	87	110	68	79	93	74	72
1935	92	91	117	58	72	89	68	75
1936	89	51	113	65	74	95	77	85
1937	95	51	113	71	79	102	85	93
1938	92	51	113	73	81	104	87	95
1939	89	53	113	73	79	101	87	93
1940	96	53	113	72	77	102	87	....
1941	102	54	110	73	82	106	87	....
1942	112	59	129	73	85	106	84	....
1943	117	55	121	73	82	105	83	....
1944	120	58	125	73	82	105	83	....
1945								
April	121	61	127	75	84	108	83	....
May	121	61	127	75	84	108	83	....
June	121	61	127	66	74	95	80	....
July	121	61	127	70	79	101	82	....
August	121	61	127	70	79	101	82	....
September	121	61	127	70	79	101	82	....
October	121	61	129	75	84	108	83	....
November	121	61	131	75	84	108	83	....
December	121	61	131	75	84	108	83	....
1946								
January	121	61	131	75	84	108	83	....
February	121	61	131	75	84	108	83	....
March	121	61	131	75	84	108	83	....
April	121	61	131	75	84	108	83	....

Combined Index Numbers of Prices of Fertilizer Materials, Farm Products and All Commodities

	Farm prices*	Prices paid by farmers for commodities bought*	Wholesale prices of all commodities†	Fertilizer materials‡	Chemical ammoniates	Organic ammoniates	Superphosphate	Potash
1922.....	132	149	141	116	101	145	106	85
1923.....	143	152	147	114	107	144	103	79
1924.....	143	152	143	103	97	125	94	79
1925.....	156	156	151	112	100	131	109	80
1926.....	146	155	146	119	94	135	112	86
1927.....	142	153	139	116	89	150	100	94
1928.....	151	155	141	121	87	177	108	97
1929.....	149	154	139	114	79	146	114	97
1930.....	128	146	126	105	72	131	101	99
1931.....	90	126	107	83	62	83	90	99
1932.....	68	108	95	71	46	48	85	99
1933.....	72	108	96	70	45	71	81	95
1934.....	90	122	109	72	47	90	91	72
1935.....	109	125	117	70	45	97	92	63
1936.....	114	124	118	73	47	107	89	69
1937.....	122	131	126	81	50	129	95	75
1938.....	97	123	115	78	52	101	92	77
1939.....	95	121	112	79	51	119	89	77
1940.....	100	122	115	80	52	114	96	77
1941.....	124	131	127	86	56	130	102	77
1942.....	159	152	144	93	57	161	112	77
1943.....	192	167	150	94	57	160	117	77
1944.....	195	176	151	96	57	174	120	76
1945								
April.....	203	180	154	97	57	175	121	78
May.....	200	180	154	97	57	175	121	78
June.....	206	180	155	95	57	175	121	69
July.....	206	180	154	96	57	175	121	74
August....	204	180	154	96	57	175	121	74
September.	197	181	153	96	57	175	121	74
October...	199	182	154	97	57	175	121	78
November.	205	182	156	97	57	175	121	78
December .	207	183	156	97	57	175	121	78
1946								
January...	206	184	156	97	57	175	121	78
February..	207	185	156	97	57	175	121	78
March....	209	187	158	97	57	175	121	78
April.....	212	188	160	97	57	175	121	78

* U. S. D. A. figures. Beginning January 1946 farm prices and index numbers of specific farm products revised from a calendar year to a crop-year basis. Truck crops index adjusted to the 1924 level of the all-commodity index.

† Department of Labor index converted to 1910-14 base.

‡ The Index numbers of prices of fertilizer materials are based on original study made by the Department of Agricultural Economics and Farm Management, Cornell University, Ithaca, New York. These indexes are complete since 1897. The series was revised and reweighted as of March 1940 and November 1942.

[1] Beginning with June 1941, manure salts prices are F. O. B. mines, the only basis now quoted.

**** The annual average of potash prices is higher than the weighted average of prices actually paid because since 1926 better than 90% of the potash used in agriculture has been contracted for during the discount period. From 1937 on, the maximum seasonal discount has been 12%.**

REVIEWS

This section contains a short review of some of the most practical and important bulletins, and lists all recent publications of the United States Department of Agriculture, the State Experiment Stations, and Canada, relating to Fertilizers, Soils, Crops, and Economics. A file of this department of BETTER CROPS WITH PLANT FOOD would provide a complete index covering all publications from these sources on the particular subjects named.

Fertilizers

"Eighth Annual Report of the Arizona Fertilizer Control Office," Agr. Exp. Sta., Univ. of Ariz., Tucson, Ariz., Sp. Bul., Feb. 1946.

"Fertilizers for Sugar Beets on Some California Soils," Agr. Exp. Sta., Univ. of Calif., Berkeley, Calif., Bul. 694, Nov. 1945, Ray A. Pendleton and W. W. Robbins.

"Manure Is Worth Money, It Deserves Good Care," Ext. Serv., Univ. of Ill., Urbana, Ill., Cir. 595, Dec. 1945, C. M. Linsley and F. H. Crane.

"Fertilizer Tonnage Sold in Indiana as Reported by Fertilizer Manufacturers from January 1 to December 31, 1945, Purdue Univ., Lafayette, Ind., F. W. Quackenbush.

"Cooperative Potash Demonstrations for 1945," Ext. Serv., L.S.U., Baton Rouge, La., R. A. Wasson.

"Tonnage of Different Grades of Fertilizer Sold in Michigan in 1945," Soil Science Dept., Mich. State College, Lansing, Mich.

"Fertilizer Trials on Corn and Oats in Mower County, 1945," Agr. Exp. Sta., Hormel Inst., Univ. of Minn., St. Paul, Minn., S.S. 15, March 1946, A. C. Caldwell.

"Fertilizer for Potatoes on the Light-Textured Soils of East-Central and North-Central Minnesota," Agr. Exp. Sta., Univ. of Minn., St. Paul, Minn., S.S. 16, March 1946, L. E. Dunn and C. O. Rost.

"Fertilizer Sales in Ohio in 1945," Dept. of Agron., Ohio State Univ., Columbus, Ohio.

"Effect of Large Amounts of Phosphates upon Yield and Composition of Grasses," Agr. Exp. Sta., A. & M. College, College Station, Texas, P.R. 983, J. F. Fudge and G. S. Fraps.

"Wisconsin 1945 Commercial Fertilizer Summary," State Dept. of Agr., Madison, Wis.

"Food Crops Need Phosphate," U.S.D.A., Washington, D. C., AIS-46, Jan. 1946.

Soils

"Map of Soil Zones of Alberta," Univ. of Alberta Ext. Dept., Edmonton, Alberta, Can.

"Collecting Soil Samples for Chemical Analysis," Ga. Exp. Sta., Univ. System of Ga., Experiment, Ga., Cir. 148, Dec. 1945, L. C. Olson and R. P. Bledsoe.

"Illinois Soil Experiment Field Data Sheets," Dept. of Agron., Univ. of Ill., Urbana, Ill., AG1141, March 15, 1946.

"Soil Conservation Districts in Massachusetts," Ext. Serv., Mass. State College, Amherst, Mass., Sp. Cir. 131, Nov. 1945.

"The Importance of Soil Organic Matter," Agr. Exp. Sta., Univ. of Minn., St. Paul, Minn., S.S. 14, April 1945, C. O. Rost.

"Soil Testing," Agr. Exp. Sta., Raleigh, N. C.

"Preventing Soil Erosion," Agr. Ext. Serv., Pa. State College, State College, Pa.

"Practical Land Clearing on the Cumberland Plateau," Agr. Exp. Sta., Univ. of Tenn., Knoxville, Tenn., Bul. 198, Nov. 1945, J. J. Bird.

"Report of the Chief of the Soil Conservation Service, 1945," U.S.D.A., Washington, D. C., Sept. 15, 1945.

Crops

"Crimson Clover for Winter Grazing," Ext. Serv., Ala. Polytechnic Inst., Auburn, Ala., Cir. 312, July 1945, J. C. Lowery and D. R. Harbor.

"Outdoor Roses in Canada," Div. of Hort., Dept. of Agr., Ottawa, Can., Publ. 777, F. B. 133, Jan. 1946, R. W. Oliver.

"The Improvement of Naturally Cross-Pollinated Plants by Selection in Self-Fertilized Lines," Agr. Exp. Sta., New Haven, Conn., Bul. 490, Oct. 1945, W. R. Singleton and O. E. Nelson.

"Sweet Corn Trials, Mt. Carmel and Windsor, Connecticut 1945," Agr. Exp. Sta., New Haven 4, Conn., R.P. 45G2.

"Farming for Freedom," Agr. Ext. Serv., Univ. of Del., Newark, Del., Bul. 41, A.R. 1943.

"Cotton Variety Tests in Georgia, 1942-45," Ga. Exp. Sta., Univ. System of Ga., Experiment, Ga., Cir. 149, Feb. 1946, W. W. Ballard, A. L. Smith, and R. P. Bledsoe.

"Peanut Yields Can Be Doubled," Ga. Exp. Sta., Experiment, Ga., Press Bul. 557, Jan. 3, 1946.

"Illinois Hybrid Corn Tests 1945," Agr. Exp. Sta., Univ. of Ill., Urbana, Ill., Bul. 517, Feb. 1946.

"Grass or Gullies," Ext. Serv., Univ. of Ill., Urbana, Ill., Cir. 593, Oct. 1945, E. D. Walker and R. C. Hay.

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596, Dec. 1945, G. H. Dungan and O T. Bonnett.

"Why Cultivate Corn?" Ext. Serv., Univ. of Ill., Urbana, Ill., Cir. 597, Jan. 1946, D. C. Wimer.

"Sow Adapted Varieties of Spring Oats," Agr. Exp. Sta., Univ. of Ill., Urbana, Ill., Cir. 601, Feb. 1946, G. H. Dungan and O. T. Bonnett.

"Twenty-eighth Annual Report," Ill. State Dept. of Agr., 200 State Capitol, Springfield, Ill.

"Trees for Reforestation in Indiana," Agr. Exp. Sta., Purdue Univ., Lafayette, Ind., Cir. 306, 1945, Daniel DenUyl.

"The Iowa Corn Yield Test 1945," Agr. Exp. Sta., Iowa State College, Ames, Iowa, Bul. P79, Feb. 1946, Joe L. Robinson and Francis Reiss.

"Lespedeza in Kentucky," Agr. Ext. Div., Univ. of Ky., Lexington, Ky., Cir. 407, Aug. 1945, E. J. Kinney, Ralph Kenney, and E. N. Fergus.

"Annual Report for Fiscal Year Ending June 30, 1945," Agr. Exp. Sta., Mass. State College, Amherst, Mass., Bul. 428, Oct. 1945. A. H. Lindsey.

"Experimental Study of Convergent Improvement and Backcrossing in Corn," Agr. Exp. Sta., Univ. of Minn., St. Paul, Minn., T. Bul. 172, Feb. 1946, H. K. Hayes, E. H. Rinke, and Y. S. Tsiang.

"Vegetable Plant Growing Reminders," Agr. Ext. Serv., Univ. of Minn., St. Paul, Minn., E. Pamph. 146, March 1946, Leon C. Snyder.

"Tung Culture in Southern Mississippi," Agr. Exp. Sta., Miss. State College, State College, Miss., Bul. 409, Oct. 1944, S. R. Greer, T. E. Ashley, G. F. Potter, and Ernest Angelo.

"Wild Flowers of Mississippi," Agr. Exp. Sta., Miss. State College, State College, Miss., Bul. 417, June 1945, Ferris S. Batson and George W. Johnston.

"Cotton Varieties in the Hill Section of Mississippi 1945," Agr. Exp. Sta., Miss. State College, State College, Miss., Bul. 426, Dec. 1945, J. Fred O'Kelly.

"Twenty-ninth Annual Report of the New Jersey State Department of Agriculture," Trenton, N. J., June 30, 1944.

"Fifty-fifth Annual Report," Agr. Exp. Sta., N. M. College of A. & M., State College, N. M.

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"Sixty-fourth Annual Report for the Year Ended June 30, 1945," N. Y. State Agr. Exp. Sta., Geneva, N. Y.

"The Farm and Home Garden Manual," Agr. Ext. Serv., Univ. of N. C., Raleigh, N. C., Cir. 122, Rev. Dec. 1945, H. R. Niswonger.

"1945 Hybrid Corn Field Trials," Agr. Exp. Sta., N. D. Agr. College, Fargo, N. D., Agron. Mimeo. Cir. 77, Jan. 1946, William Wiidakas and L. A. Jensen.

"Effect of Chloride on Physical Appearance and Chemical Composition of Leaves on Pecans and Other Native Oklahoma Trees," Agr. Exp. Sta., Okla. A. & M. College, Stillwater, Okla., T. Bul. T-23, March 1946, Horace J. Harper.

"The Ideal Home and Market Fruit, Red Raspberries," Agr. Ext. Serv., Univ. of Tenn., Knoxville, Tenn., Sp. Cir. 214, Jan. 1946, Brooks D. Drain.

"Making New Peach Trees," Agr. Ext. Serv., Univ. of Tenn., Knoxville, Tenn., Sp. Cir. 217, Jan. 1945.

"Strawberry Production in Tennessee," Agr. Ext. Serv., Univ. of Tenn., Knoxville, Tenn., Sp. Cir. 236, May 1945, N. D. Peacock.

"Youngberry, Boysenberry, Nectarberry, and Dewberry Growing in Tennessee," Agr. Ext. Serv., Univ. of Tenn., Knoxville, Tenn., Sp. Cir. 245, Sept. 1945, L. L. Davis.

"Fruiting and Shedding of Cotton in Relation to Light and Other Limiting Factors," Agr. Exp. Sta., A. & M. College, College Station, Texas, Bul. 677, Dec. 1945, A. A. Dunlap.

"P. R. 977, Sweet Corn Varieties in the Lower Rio Grande Valley, B. S. Pickett; P. R. 978, Results of Tests in 1945 With Hybrid Corn and Corn Varieties in Texas, J. S. Robers, R. G. Reeves, and J. W. Collier; P. R. 980, Cucumber Varieties in the Wichita Valley, V. I. Woodfin and L. E. Brooks; P. R. 981, Results of Tomato Variety-Yield Tests in East Texas, P. A. Young; P. R. 982, Sweet Potato Fertilizer Studies in East Texas, R. E. Wright, Agr. Exp. Sta., A. & M. College, College Station, Texas.

"Vegetable Gardening in Vermont," Agr. Ext. Serv., Univ of Vt., Burlington, Vt., Cir. 109, Rev. March 1946, Chas. H. Blasberg.

"Growing Raspberries in Vermont," College of Agr., Univ. of Vt., Burlington, Vt., Brief. 521, Rev. March 1946, Chas. H. Blasberg.

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"Report of the State Agricultural Commission to the Governor of Virginia," Agr. Ext. Serv., Va. Polytechnic Inst., Blacksburg, Va., Bul. 166, Jan. 1946.

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"Fifty-fifth Annual Report," Agr. Exp. Sta., State College of Wash., Pullman, Wash., Bul. 470, Dec. 1945

"Pruning Fruit Trees," Agr. Ext. Serv., W. Va. Univ., Morgantown, W. Va., Cir. 341, June 1945, R H. Sudds and R. S. Marsh.

"What's New in Farm Science," Agr. Exp. Sta., Univ. of Wis., Madison, Wis., Bul. 468, 67th A. R., Part 1, 1945.

"Ladino Clover, a Promising Pasture Crop," Ext. Serv., Univ. of Wis., Madison, Wis., Cir. 367, Jan. 1946, H. L. Ahlgren and F. V. Burcalow.

"My Story, Growing Potatoes as a 4-H Project," Ext. Serv., Univ. of Wis., Madison, Wis., Cir. 4H-48, Oct. 1945.

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"Continuous Submergence Controls Weeds in California Rice Fields," U. S. D. A., Washington, D. C., R. A. S. 55(P), March 29, 1946.

"Handling and Shipping Early Potatoes," U. S. D. A., Washington, D. C., Cir. 744, Jan. 1946, D. H. Rose.

"Lespedeza Culture and Utilization," U. S. D. A., Washington, D. C., F. B. 1852, Rev. Jan, 1946, Roland McKee.

"Improving Pastures and Grasslands for the Northeastern States at the U. S. Regional Pasture Research Laboratory," U. S. D. A., Washington, D. C., M. P. 590, Feb. 1946.

"Effect of Variety, Location, and Season on Oil, Protein, and Fuzz of Cottonseed and on Fiber Properties of Lint," U S. D. A., Washington, D. C., T. Bul. 903, Nov. 1945, O. A. Pope and J. O. Ware.

Economics

"1944 Citrus Production Cost Study, Lemons & Grapefruit," Agr. Ext. Serv., Univ. of Calif., Berkeley, Calif.

"1944 Orange Production Cost Study, Navels & Valencias," Agr. Ext. Serv., Univ. of Calif., Berkeley, Calif.

"1945 Desert Grapefruit Management Study Imperial County," Agr. Ext. Serv., Univ. of Calif., Berkeley, Calif.

"Canadian Agricultural Program for 1946," Agr. Supplies Board, Dept. of Agr., Ottawa, Canada.

"Choosing a Connecticut Farm," Ext. Serv., Univ. of Conn., Storrs, Conn., Bul. 372, Aug. 1945, B. D. Crossmon.

"Vegetable Production and Marketing in Georgia Mountain Counties," Ga. Exp. Sta., Univ. System of Ga., Experiment, Ga., Bul. 240, Feb. 1946, N. M. Penny.

"1945 Summary of Fruit and Vegetable Unloads at Honolulu," Agr. Ext. Serv., Univ. of Hawaii, Honolulu, T. H., Cir. 186, Jan. 1946.

"Tax Exemption Requirements and Accounting Terms for Cooperatives," Agr. Ext. Serv., Univ. of Hawaii, Honolulu, T. H., Cir. 198, March 1946, Ralph Elliott.

The Soil Is Our Heritage

(*From page* 24)

waterways were established everywhere there was a wash. A long-time crop rotation was set up. Permanent pastures were laid out for some areas, legume crops seeded in other areas, and the whole farm was to be given an application of fertilizer as fast as the income would permit, not just any kind of fertilizer but specific types of plant food the soil tests showed were lacking.

The old farm that was once so fertile and then so poor seemed definitely to be on the road back.

Then the youthful farmer was fatally injured in a farm accident. Mrs. Kreider, the widowed mother, was unable to continue operation of the farm, which she later offered to Ivan Hardin for sale.

Hardin, after examination of the experimental demonstration plan outlined for the farm by Purdue University, offered to continue the program as originally set up.

It was about the time World War II started that Hardin purchased the farm. Productivity of the farm in recent years has been little short of phenomenal.

Pasture on the farm adequately supports Hardin's 30-head herd of purebred Guernseys, and the increased productivity of cropland is such that it is no longer necessary to rent additional land.

This past year the Hardin farm produced so much hay that tenant Marvin King couldn't use it all. The first cutting of alfalfa was damaged by rain and so some of it is being used for bedding and the remainder, amounting to many tons, is piled up to decay and be returned to the soil. The second cutting furnished ample hay of excellent quality for winter roughage. The third crop was never cut. Both Hardin and King are extremely "organic matter" conscious and preferred to turn under

the crop rather than to harvest it for the market.

Grass in the pasture land was belly-deep to the dairy herd by midsummer. In addition to bluegrass and alfalfa there were many experimental plantings that produced a variety of dairy feed. For example, there was ladino, lespedeza, sudan, brome, red clover, alsike clover, timothy, sweet clover, balbo rye, wheat, and oats. Obviously, all these crops will not be continued. Meanwhile the sleek dairy herd that roams the Hardin farm have about the widest variety of available feed any cows could have. As a result, the milk checks are running well over $200 a month the year round. Hardin and King could easily sell enough surplus legume hay to purchase supplemental dairy food. They keep a small herd of hogs which, too, are offered a wide choice of feed. Part of the corn crop goes into the silo and the balance is turned into ground feed. The farm is once again capable of producing 100 bushels of corn per acre.

This high state of productivity has been developed on the Hardin farm through a rather intensive application of plant food. During the past six years the soil has had the following plant food in addition to tons and tons of manure hauled from the dairy barn; 21,600 pounds of 45 per cent phosphate; 2,700 pounds of 60 per cent muriate of potash; and 1,800 pounds of 33 per cent ammonium nitrate. These applications were in addition to standard fertilizer the equivalent of 2-12-12 at the rate of approximately 300 pounds per acre. This application was given the pasture land as well as crop land.

Hardin and King were asked recently if all this experimentation was not a costly lot of fuss and bother. Both agreed conclusively that on the contrary they have had a lot of fun watching the soil respond to legume and plant-food tests and they brought out figures to show they are making a good net profit on the farm. They are ready to prove the old run-down hill farm that had lost more than six of its original nine inches of topsoil is not washing out from under their feet every time it rains these days. They are convinced their farm is no longer crop bankrupt.

Efficient Fertilizers Needed for Profit in Cotton

(*From page* 20)

phate. In 1945, with severe weevil injury, 50 pounds of P_2O_5 increased the yield 476 pounds per acre. Contrary to the effects of nitrogen and potash, phosphate had no effect on the composition of the seed.

Reasonably heavy applications of P_2O_5 every year are necessary to insure rapid plant development and high yields. About 50 to 100% more phosphate is needed in the cotton fertilizers on Piedmont soils than on Coastal Plain soils.

Lime

Last, but not least, broadcast applications of dolomitic limestone are necessary on some soils to supply adequate calcium and magnesium. Characteristic magnesium-deficiency symptoms, red leaves with green veins, are found on cotton grown on some of the light sandy soils.

In experiments with dolomitic and calcitic limestone in 1945, dolomitic limestone was particularly beneficial. (See Table 1.) There was practically no response to calcitic limestone while dolomitic limestone gave responses of 183 and 175 pounds of seed cotton, respectively, at the first two locations. The response was not related entirely to the exchangeable magnesium in the soil but came at the locations with severe weevil injury. In 1944 on Norfolk loamy sand (pH 5.1, ex. cap. 2.8,

TABLE 1. EFFECT OF PHOSPHATE AND LIME ON COTTON YIELDS
(pounds of seed cotton per acre)

Treatment	Lbs. P_2O_5/A applied	Ruston loamy sand 1945	Norfolk fine sandy loam 1945	Norfolk fine sandy loam 1945	Lbs. P_2O_5/A applied	Cecil gravelly loam		Norfolk fine sandy loam	
						1944	1945*	1944	1945
		Lbs/A	*Lbs/A*	*Lbs/A*		*Lbs/A*	*Lbs/A*	*Lbs/A*	*Lbs/A*
Dolomitic lime (1T.)	20	1,230	944	1,652	0	1,390	1,349	1,396	1,074
Dolomitic lime (1T.)	60	1,524	1,342	1,606	50	1,695	2,232	1,482	1,550
Calcitic lime (1T.)	60	1,356	1,222	1,469	100	1,988	2,018	1,435	1,685
No lime	60	1,341	1,167	1,508					
L. S. D. (.05)		147	197	219		264	251	232	172
Soil Analysis									
pH		4.7	5.0	5.2		6.4		6.0	
B. Ex. Cap. (m.e.)		1.6	2.9	3.1		3.9		4.1	
Ex. Ca (m.e.)		0.46	1.02	1.36		1.31†		1.04†	
Ex. Mg (m.e.)		0.18	0.30	0.19		0.37†		0.24†	
Ex. K (m.e.)		0.04	0.10	0.11		0.09		0.04	
Soluble P (ppm.)		8.0 Severe weevil damage	43.0 Severe weevil damage	43.0		trace		18.0	Severe weevil damage

* 0, 100, and 200 lbs. P_2O_5/A, respectively.
† Before one ton of dolomitic lime was added.

ex. Ca 0.29, ex. Mg 0.13) one ton of lime increased the yield 419 pounds per acre.

Applications of limestone are best made on the basis of soil requirements as determined by soil tests. In North Carolina this soil-testing service is easily available to the growers.

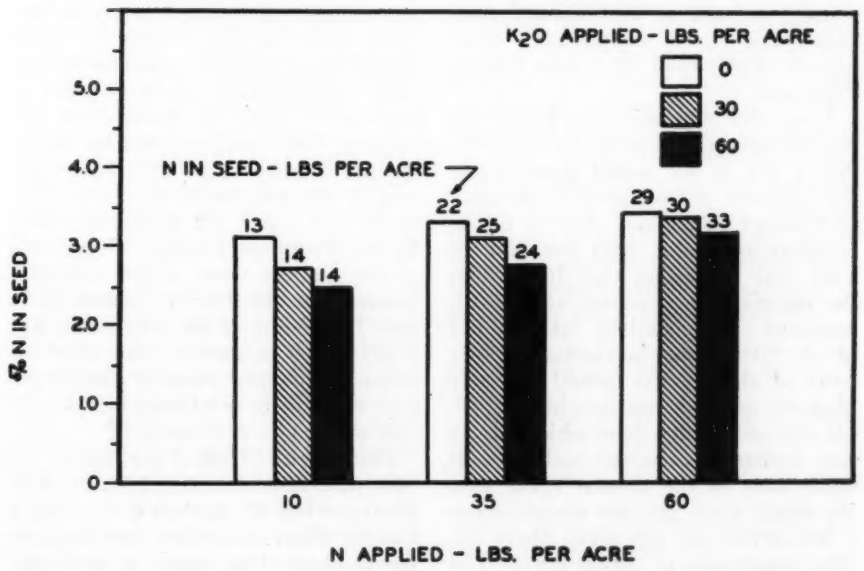


Fig. 5. Under conditions of a response in yield of lint to potash and nitrogen additions, the percentage and the total amount of nitrogen in the seed are affected.

Summary

Adequate quantities of nutrients must be supplied to the cotton crop if high yields are to be produced. If the maximum returns are to be obtained from the nutrients, they should be placed in bands at the side of the seed rather than directly under.

The response to fertilization, particularly to nitrogen, is complicated by boll-weevil injury in some areas in certain years. A good system of boll-weevil control will make possible greater returns from high fertilization.

I Saw It Happen in the Soil Testing Laboratory

(*From page* 14)

the same personnel to do all of the work throughout the year. There is still a peak of work during the spring, but it is not a very severe one.

Summary of Soil Tests

From the 16,000 samples tested last year, some interesting things were observed. In interpreting the data from these tests, the State was divided into five soil areas; namely, the Mountain, the Piedmont, the Sand Hill, Upper Coastal Plain, and Lower Coastal Plain areas. The principal difference between the latter two groups is that the Lower Coastal Plain soils often have a finer texture, are not as well drained, and consequently have considerably more organic matter than the Upper Coastal Plain soils.

Lime Recommendations. Lime recommendations were made on the thesis that a pH of 6.0 would approximate the optimum pH for greatest efficiency of fertilizer utilization. This is not in complete agreement with the work of Volk and Bell, since they found that the retention of ammonia and potash increased very materially up to a pH of 6.8. Many other authorities in other parts of the country would probably place the optimum up to as high as 6.5. On the soils of this State which have a low exchange capacity, such as our sandy soils of the Coastal Plain area, we would often get into complications if we carried our pH much above 6.0. The assimilation of potash seems to be very materially reduced, and in many cases minor plant-food element troubles develop above a pH of 6.0. This is particularly true of soybeans, in which case the plants often develop manganese deficiency with a pH even approaching 6.0 on the sandy soils. Such lime-loving crops as alfalfa and sweet clover grow very satisfactorily at a higher pH, but also usually do well on a pH of 6.0 on most soils utilized for these crops.

Of course, the entire rotation must of necessity be considered in any well-planned lime and fertilizer program. If, included in a rotation where the pH is as high as 6.0, there are crops which would constitute a problem, the liming program should be adjusted accordingly. It is very desirable to lime a soil where the pH is below 5.0 for all general crops; and it is desirable to lime most general crops where the pH is between 5.0 and 5.5. Many crops will respond very nicely to liming where the pH is from 5.5 to 6.0. Thirty per cent of the soils tested from the Piedmont area had a pH of 6.0 or above. In one Piedmont County, 55 per cent of the samples were in this category; whereas, in the Lower Coastal Plain only 11 per cent of the soils tested had a pH of 6.0 or above. The other extreme of this lime status is that 39 per cent of both the Piedmont and Mountain soils had a pH below 5.0.

Phosphorus. Only 3 per cent of the Mountain soils were very high in phosphorus, while 32 per cent of the Upper Coastal Plain soils were very high in this element. One county in the Upper Coastal Plain had 41 per cent of its soil testing very high in phosphorus. On

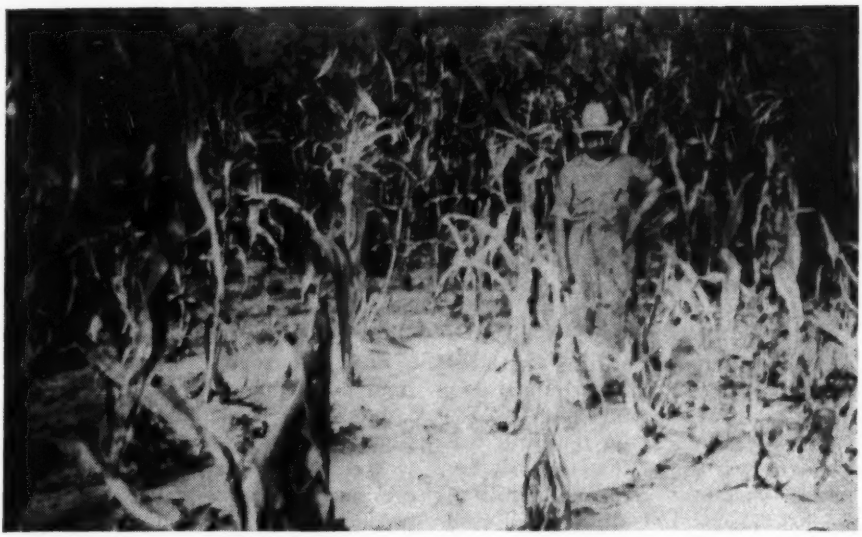


Fig. 3. This is an over-limed spot on Norfolk fine sandy loam soil. It has a pH of 8.1 and the the calcium and magnesium are very high.

the other extreme, 72 per cent of the Mountain soils and 8 per cent of the Upper Coastal Plain soils were low in phosphorus.

Potash. The tests showed 23 per cent of the Mountain soils and 6 per cent of the Sand Hill soils to be fairly high in potash. The other extreme on potash showed 13 per cent of the Mountain soils and 45 per cent of the Sand Hill soils very definitely low in this element. Even the Upper Coastal Plain area—which is perhaps the most highly fertilized area in the State—showed 35 per cent of the soils to be very definitely low in potash.

This very brief summary of the soil tests in general shows that very many fields have been amply limed and that some have even been over-limed. On the other hand, the lack of lime is a seriously limiting factor on large areas of the State. As an over-all picture, the lack of lime far overshadows the small portion of the State which has been amply limed. Only a fraction of the lime that is needed is actually being used.

Many of the soils of the Upper Coastal Plains are well supplied with phosphorus, while the Mountain and Piedmont areas need all of this surplus and more.

The Mountain soils are fairly well supplied with poash and some of the Piedmont soils are also, but more soils in these two groups are becoming deficient in this element each year. Most of the soils in the Coastal Plain and Sand Hill areas are quite deficient in potash. A generalization like this, however, may be ruinous to any individual farmer or field, since adjoining fields are often very different. Every field, and every crop that is planted on that field, is an individual problem all of its own, and should be so treated.

Karraker, P. E. *Soil Test for Lime and Fertilizer,* University of Kentucky, Leaflet 74, 1944.

Ronnie, Dale S., and DeVerre R. McAllister. *Soil Laboratories Cooperating on Soil Testing: How to Take Samples for Tests Explained,* Colorado Farm Bul. VI, No. 2, Page 3, 1944.

Smith, F. B., and Geo. D. Thornton. *Soil Testing,* University of Florida, Agri. Exp. Station, Press Bul. No. 617, 1945.

Volk, G. M., and C. E. Bell. *Soil Reaction (pH),* University of Florida, Agri. Exp. Station, Bul. 400, 1944.

Corn Production In Mississippi

(*From page* 26)

"I ran out the middles with a 14-inch sweep and scratched around the row. Then on June 25, I ran around the row with a 14-inch sweep and on the 27th I side-dressed it with nitrate of soda at the rate of 200 pounds per acre except on the five rows which were left for the check.

"On July 10, I went twice to the middle with a scratcher stirring the clods around, because it had not rained during all of these workings.

"When the check on the yield was made, it was found that the plot fertilized with the complete fertilizer, 6-8-8, produced 130½ bushels of corn to the acre. The plot where nitrogen only was used produced 96 bushels per acre. The check plot where no fertilizer was used produced 70 bushels per acre, or 60½ bushels less than the plot where the complete fertilizer was used.

"My advice to anyone who is a member of the 4-H Corn Club or who is carrying any other 4-H project is to check with the 4-H Club agent or any member of the Extension Service if he wants to do an excellent job.

"To grow 100 bushels or more of corn per acre, one must prepare a good seedbed, use the correct fertilizer, space closely in the row, and properly cultivate. With this in mind and using good seed, everyone can be a winner.

From reports and comments received from hill counties and Delta counties, farmers, club boys, county agents, assistant agents, and other agricultural workers are this year outdoing anything previously done about improving corn production in Mississippi. It now appears that 300 to 400 corn demonstrations are being conducted by juniors and adults this season.

Agricultural workers, farmers, and 4-H club boys will make organized tours in August to October to study the results of corn fertilization, close spacing of corn, and several hybrid corns in these demonstrations.

General acceptance of improved prac-

Proper fertilization increases production of forage as well as grain.

SPECIAL 4-H CORN PRODUCTION CONTEST RECORDS

County and Name of Club Boy	Soil (Upland, Terrace, Bottom)	Fertilizer Used and Yield per Acre		
		Plot 1	Plot 2	Plot 3
		500 lbs. 6–8–8 in water furrow before bedding for planting. Side-dressed with 200 lbs. nitrate of soda or 100 lbs. ammonium nitrate per acre	200 lbs. nitrate of soda or 100 lbs. ammonium nitrate per acre in water furrow before bedding for planting. Side-dressed with 200 lbs. nitrate of soda or 100 lbs. ammonium nitrate per acre	Check—No fertilizer
		(Yield per A) (Bu)	(Yield per A) (Bu)	(Yield per A) (Bu)
Alcorn:				
Vester Smith	Bottom	97	81	74
Stanley Fields	Bottom	70	54	46
Leon Sherard	Bottom	62	55	53
Choctaw:				
Price Miller	Bottom	102	63	60
Greene:				
Chas. McLendon	Terrace	45	32	26
Lowndes:				
Walter Rex Rose	Bottom	90	48	30
Walter Rex Rose	Bottom	80	32	25
Madison:				
Eldridge Hoy		60	40	20
Tishomingo:				
J. T. Skinner	Upland	63	48	42
James Lee Coker	Terrace	72	52	36
Bobby Wimbish	Upland	70	50	28
Carroll Hester	Terrace	46	50	28
Charles Skinner	Terrace	58	58	52
Harold Davis	Terrace	72	51	48
Edgar Johnson	Upland	50	30	26
Junior Merle Hester	Bottom	130	96	70
Jimmy Kirk	Upland	81	56	36
Jimmy Enlow	Bottom	102	97	92
Dennis Smith	Bottom	116	113	90
Billy Bridges	Bottom	90	77	60
Wayne:	Bottom	60	38	18
Webster:				
Robt. Crowell	Terrace	106	99	75
Mahlon Taylor	Bottom	81	77	49
Average all reports		78	61	47

tices in corn production would soon result in plenty of grain to meet feed grain needs. With further improvements in hybrid corn prospects in the State, the total acreage now being planted to corn can be reduced considerably, thus providing more land for small grains, hay, or pasture which will need much less labor than for growing corn.

Learn Hunger Signs of Crops

(*From page* 12)

Another group of soils which are usually deficient in potassium for crop production are the alkali soils of central and northern Illinois. They contain from a few tons to a hundred or more tons of calcium carbonate per acre plow depth usually in the form of snail shell fragments. These soils have lost potassium into the drainage water faster than soils which are otherwise similar, but without excess of calcium carbonate. A probable reason is that the constant excess of calcium displaces potassium from the clay into the soil water. Moreover, these soils must contain more available potassium than non-calcareous soils, in order to deliver it into the plants because of the competition of the calcium. For every atom of potassium around the plant roots there are hundreds of calcium atoms.

These, then, are the soils that nature deprived of their available potassium reserves without much help from the farmer. There remains another very large area of Illinois soils which were well endowed with available potassium and potassium reserves when the white man began farming them. Their potassium reserves have been "farmed out" or they are approaching such a state by a system of soil management which 25 years ago was considered sound. We were deceived by 35,000 pounds an acre of total potassium in the plow depth, not knowing that 85 per cent of it is locked up in unweathered coarse particles (sand and silt) that will not furnish appreciable amounts to crops for centuries. As a result of this error, which we may as well admit, the best managed farms have had their yields greatly increased by limestone, legumes, and phosphate, at the expense of the potassium reserves which are approaching, and in many cases have reached, inadequate amounts for average yields.

In contrast to phosphorus the shortage of which is not shown by striking symptoms in any of the common crops after the seedling stage, potassium deficiency waves its flag for all to see in most kinds of crops at all stages of growth. Like phosphorus, potassium is used twice in emergencies, moving out of old leaves into younger ones, so that the symptoms move upward from the base of the plant. Being all soluble, the potassium moves out of the old leaves rapidly, killing the leaf quickly with but little yellowing, which lasts but a day or so. Potassium firing first destroys the edges of the leaves, which in corn become wavy at about the time they turn brown and die, after which the dead edges break up in the wind and become ragged. These symptoms are somewhat similar in corn, soybeans, clover, alfalfa, potatoes, and other crops. There are differences in detail of pattern, which should be seen in order to learn to recognize them.

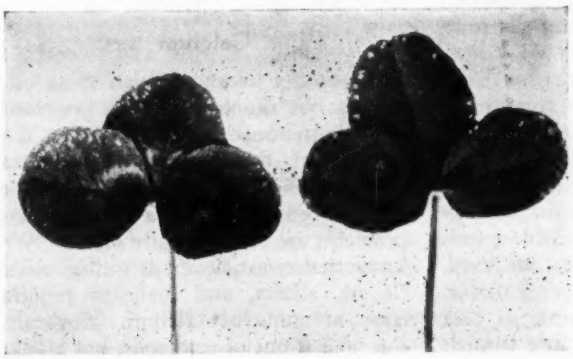
In corn there are other signs of potassium shortage. If it is severe in early stages, the whole plant dies early. If the plant lives, it fails to lengthen the stalk, so that the plant is low, with the leaves close together. It is also weak-stalked and often breaks over. If an ear forms, it may be all pollinated, but the best seeds are at the butt, becoming more and more chaffy toward the tip. The cob is weak and breaks easily.

Nitrogen

Soil nitrogen reserves reside entirely in the soil organic matter, having been added by way of vegetation and having come by more or less roundabout journeys from the atmosphere. There is no nitrogen which originated in the rocks of the earth's crust. The nitrogen reserves vary along with the organic matter from small amounts in light-colored sandy soils to rather large amounts in the dark brown to black silt and clay

loams, and to very large amounts in muck and peat soils.

Now, what of the available nitrogen which our growing crops must have? It is an old story that nitrogen is liberated from organic matter as the latter decays, but it may be a new story that plant feeding on this available nitrogen is entirely different from that on the immovable soil phosphorus and potassium. Nitrate nitrogen, the chief available form, is completely soluble in water. It is not absorbed by clay or any other soil material, but moves freely in the soil, going wherever the water goes —down to the root zone as rain water soaks in and up to the surface when the water evaporates. But it cannot follow the water into the air. A field of corn may be badly fired during a drought because of nitrogen starvation when there is enough nitrogen for a 100-bushel crop in the half-inch surface crust where there are no roots.



Above, Alfalfa; below, Red and Alsike clover. Potash deficiency is indicated by white spots on these legumes. Later, edges of leaves become dry and appear scorched.

Another result of the free movement of nitrate in the soil is that with the usual moisture conditions, crop roots have repeated opportunities to take up the nitrate as it passes by going up and down with the water movement so that in a very short time the growing crop may completely exhaust the root zone of this available nitrogen. It is indeed fortunate that weather conditions which favor crop growth also favor the decay of organic matter with continual renewal of the nitrate nitrogen.

A long-time view of the nitrogen problem has convinced me that we have been fooling ourselves in believing that with liming, legumes once in rotation, together with phosphate and potassium where needed, we have maintained our fertility, even though we have a record of many years of high yields as proof. We have frequently called attention to the fact that by our farming methods of the past we have destroyed ⅓ to ½ of our soil organic matter. But

have we realized that the nitrogen for these high yields was supplied only in part by the legumes and that the remainder of it was supplied at the expense of permanent destruction of organic nitrogen reserves? The proof of it is in the startling increase in numbers of fields of badly fired corn in good years and bad on what we have considered our better corn-belt soils. These signs do not so often appear on the unimproved soils. Phosphorus and potassium fertility there have gone down with the nitrogen, and declining yields without "hunger signs" are the results we see with such poor, but still balanced, fertility.

It is my belief that the good old days are gone. In the future, if we maintain high yield levels, and even go to super-high yields as many hope to do, there are only two roads open to us. One is to reduce the grain ratio and increase the legumes in the crop rotation above what has been considered standard, good practice and the other choice is to supplement legume nitrogen with nitrogen fertilizers.

Now as to the hunger signs. Back of the symptoms always lies the plant physiology—what is happening inside the plant. Nitrogen within the plant, like phosphorus, is about half free and half fixed in the living tissues as a part of the organic matter of the cell itself. When the soil supply slackens, the free (soluble) half is moved out of the old, lower leaves without immediate harm, but loss of the second half very gradually kills the leaf, first by yellowing, later killing the tissues along the midrib, still later spreading to the edges. The most prevalent time for this firing is when the ear begins to enlarge, or with plants other than corn, when seed production sets in—but it can happen any time.

To review briefly some main points—First, in the soil: The available forms of phosphorus and potassium are fixed, not in the old sense of not being usable, but fixed against movement, so that the advancing roots drill little tunnels through the mass of these available forms, leaving ⅔ to ¾ of it still available at the end of the season. This is true even if the plant is showing starvation symptoms because the potassium in the path of the roots is too thinly distributed, while the meager supply between the root paths is "positionally unavailable," or out of reach, and goes through the season untouched.

Whether the available phosphorus or potassium be much or little, the amount accessible to the crop increases in proportion to the expansion of the root system as the season advances. Nitrate, the principal available nitrogen, on the other hand, moves freely in the soil and can be completely taken out of the root zone by the crop in a fairly short time, except in the early growth stages.

Secondly, in the plant: these elements group themselves differently. Now phosphorus and nitrogen are grouped together. Both are a part of the vital tissues of the plant, to the extent of about half of the total amount present. The organic part moves out of these older tissues slowly, after the soluble portion has gone, of course, resulting in slow death of these leaves, accompanied by the characteristic symptoms. Potassium, in contrast, is all soluble, goes out of the old leaves quickly in time of critical shortage, with more sudden death of the tissues.

All three elements are alike in that they can be used twice, the second time to keep the most important organs functioning at the expense of older leaves that die.

Calcium

We do not know as much about calcium as we should. We are protected in our ignorance by knowing that the good crop rotations require certain legumes which do not thrive on sour soils. So we lime, and our calcium problems are automatically solved. We know that sweet clover, as well as other clovers, alfalfa, and soybeans require large amounts of calcium. Soybeans can take it out of acid soils, but alfalfa

and many clovers cannot. We do not know why. Corn uses very little calcium, but we found one inbred by accident that has a very high calcium requirement, and in this discovery we found and recognized calcium "hunger signs." In this discovery we also learned why certain hybrids had failed in early summer (rotted, the growers said) on sour soils. This inbred was one of the parental lines.

Magnesium

Magnesium occurs in common farm crops in about the same amounts as calcium. It is a constituent of chlorophyl, the green pigment in leaves. Mild deficiency is suspected but not proved in the gray prairie in southern Illinois. We forced a magnesium deficiency in corn on that soil by adding eight tons of potash per acre which pushed the magnesium down into the subsoil. The symptoms appeared soon after pollination and consisted of whitish yellow striping along the veins of the leaves with an occasional red stripe.

Iron

Iron shortage in most plants causes chlorosis (loss of green color) in the younger leaves near the top of the plant. The golden yellow color which covers the whole leaf persists for a long time—two to three weeks—before the leaf dies, and if iron is supplied in the meantime, the green color is restored. Iron deficiency is rare in Illinois soils, but may occur on shelly alkali areas.

Boron

Boron, like iron, is a trace element. Its severe deficiency is wide-spread in many truck crop areas of Michigan and Wisconsin as well as some southeastern states. Alfalfa suffers from boron shortage in the soils of the southern third of Illinois and in scattered small areas elsewhere. Like iron, the symptoms are in the upper or youngest part of the plant. The older leaves obtained their supply before the soil supply was exhausted. The symptoms usually appear in the second or later years in alfalfa and in the second or third cutting or both—all after the root system is established. After the boron is deposited in the cells of the plant, it is fixed there and cannot be re-used as is nitrogen, or phosphorus, or potassium. This fact explains the "hunger signs" in the top of the plant. The surest symptom for diagnosis in alfalfa is death of the terminal bud of the main stem and growth of the upper branches until they are higher than the main stem, causing a rosette-like arrangement of the leaves. Less important symptoms are yellow and pink leaves in the upper third of the plant.

Copper-Zinc

Copper and zinc deficiencies have been established in some areas of the United States, but not in Illinois. This does not mean that we should be complacent and wait for actual plant starvation. We hope to make a survey of Illinois soils for these elements as soon as facilities and man-power will permit.

Iodine-Cobalt

Iodine and cobalt are chemical elements essential in trace elements for animals, but not known to be necessary for plants. Since they can be added to animal feeds or salt mixtures, it is not necessary for animals or men to obtain them from the soil through plants. However, on ranges where no feeding is done, soil applications may be desirable.

In parts of Australia and New Zealand in recent years, the range production of sheep and cattle came dangerously near to a disastrous end until it was discovered that application of 4 to 16 ounces of cobalt per acre to the ranges by airplane would solve the problem for two or more years.

Parity and Charity

(*From page* 5)

contest to originate a newer and better and fairer system of formulas on which to erect a lasting agricultural parity platform, one that Congress might adopt if it is wise enough to take a broad attitude rather than a sectional one. For the present moment the backgrounds behind the proposals advanced in that contest of wit and wisdom have little place in discussion, as they relate to a long-time, future policy, with or without prosperity.

AS FAR as our production prospects in America go, they are much brighter and better per farm than they are abroad. That much we know. It's the consuming and the selling side that bothers so many of us in casting up our horoscopes. If that is true, then we must watch and cheer hard for all workable plans advanced in coming months and years to increase the volume of food products moving in the channels of world commerce, to and fro, in and out. Can we do that by setting our own financial sights per bushel or per ton so high that exports are impossible except with a public subsidy? That goes for other countries as well.

Speaking again of production outlooks in the long run, I quote from a letter received lately from a farm paper editor long known to me, who has been interviewing farmers in all corners of the food-deficit areas. In contrast to our own expected powerful food-producing possibilities—even greater than they have been since 1941—here is what this writer says about European agriculture:

"The long-term agricultural problem is the acute shortage of land in a majority of the countries visited. Greece, for instance, has only four or five acres per farm and not very good land at that. Cash income above farm living costs is about $125 per family per year. You might say that increased industrialization will remove some of these people from the land, and that better farming systems and better livestock will help. Yet even then there remains a land shortage which will prevent the average farmer here from ever approaching the high standard of living we have in the United States."

He also reports that few farmers in Italy lift up their hopes high enough to attain land ownership. Here we have plenty of such hopes all right, but hardly enough money and brains and grit to carry through, in far too many cases. Ownership, of course, is not entirely the answer. But the utter absense of ambition, such as he saw abroad, strikes at the root of world welfare and agricultural progress.

Right here there enters the need for active resistance to exploitation. That evil has already robbed Europe of many tons of soil fertility and human ambition. It can happen here if we don't watch out. In the regeneration of Europe with our assistance, we must have a care not to use our forces and facilities for the kings of entrenched privilege instead of the down-trodden hosts on whom the world depends for consumption and mass production. This is not silly, vain preachment, but ordinary common sense. We must get the facts from overseas in return for our relief efforts. If we quit without facing further responsibility than that of putting out a fire, we may not have anything to say about the kind of buildings and institutions erected in their places. And believe "you me," in this shrinking world of ours, what happens over there will affect our lives and fortunes just as much as what we do with parity over here.

Continuing the quote from our editor abroad:

"The battle is over but the problems of war remain. They are magnified by the terrific destruction. The United States can be a great moral and economic force in the regeneration of Europe if it wishes. I believe we are not being realistic unless we see this fact and take positive steps in this direction."

Were we to lay a yardstick of parity alongside our own agricultural and national prosperity and privileges and compare it with most of the other countries, the evidence would be plain. We base our bedrock period from which we reckon farm price parity in the assumed "golden age" of fair exchange value, from 1910 to 1914, when life was simpler, wants were fewer, and our farming systems and individualism were more comparable to European agriculture than they have become since farming became commercialized. We have gone ahead to perfect our power farming, and our multiple organizations, leaving the foreign peasant about where he was at the turn of the century. Now the prime sixty-four dollar question is whether we alone in our own domestic circles can swing this parity club on every occasion with no thought of the results both to ourselves and the world in general.

JUST what the outcome of further internal pressures may be, no man can say. Some recent editorials in high places have accused the American farmer of keen greed, intimating that he is merely imitating the actions of the business groups who have forgotten what the war was for and push mainly for the dollar sign.

I am not so much afraid of the greed of the farmer as I am concerned lest he become giddy, dazed, and cuckoo over so many rapid contradictions and disappointments in return for his national deposit of patience, forbearance, and loyalty.

Largely because the farm folks I know best are outspoken sometimes to their friends, I think I have some insight into the situation. Because the majority of the farmers really do not know exactly what parity stands for but are fully aware of what charity signifies, and because they would rather produce a surplus for charity than to store it away to be haggled over through parity, it means using all-out efforts for a bumper crop in 1946.

I am sure that this is the correct hunch. I am positive that farmers prefer risking one year's surplus for charity or relief to piling up perfectly good victuals until the proper bargain can be struck in exchange.

Perhaps I am too free in using the "charity" term respecting the food relief tonnage expected of our farmers. However, it may be a trifle early to start any squabble between us over the terms on which settlement, if any, will be made. It's true the farmer is not exactly selling wheat on a charity market in terms of his own private income. But maybe America is, and if so, what about it?

Well, I suspect that such a gift for human welfare and maintenance of decent order and a stimulation of renewed hope abroad would be like the proverbial bread on the flowing waters. I would think so but for one recurring thought—that too few of our foreign folks can revive much confidence in the future by reason of so many disasters in the recent past. If we could send them some bond of unity and give them some strength of soul along with the food we dole out, and if we could stick to this new international feeling awhile to see things through, the whole investment would pan out.

Some of my friends are bound for London this month to share in the fresh experience of starting a new international farmers' association. I think they will return home with a broader outlook and a more serious opinion than some of them have had before relative to the interdependence of nations in a world grown smaller.

You and I can recall the days when the local township and its doings and public affairs, its markets and its successes were the sum total of our horizon and all we seemed to require for reasonable prosperity and content.

Gradually through our later lives the county, then the state, then the region, and finally, the commodity bloc, assumed the center of the stage in our thinking and our planning for agriculture. We were not satisfied to send delegates to the Grange state convention or elect men to state assemblies. It became our purpose to set up skillful representatives in every state capital and in the largest industrial market places, as well as at Washington.

Finally after fighting two world wars over narrowness and bigotry, we find our farm leaders—and other ones too—standing down on the shores of the ocean, wondering what lies beyond for future organization and greater power and strength. Agriculture has in fact outgrown its old American birthplace and environment and is about to step across the international barrier—and we hope strip that barrier meanwhile of much cluttering tariffs and misunderstandings.

ALL of this painful growing spasm we have experienced during the past transition period could hardly have been avoided and it did some of us good. Some of us made mean remarks and said unkind things about brother farmers, but most of that is laid aside like old army relics.

Yet we are not quite to the hands-across-the-sea phase until we find out how to cure our own ills and are willing to be charitable among our own home folks. My hunch is that if we put more emphasis on charity and less on parity—the kind we keep on hiking after but never reach—the way will be smoother for our brogan-shod feet as well as for the atomized aircraft of the coming generation.

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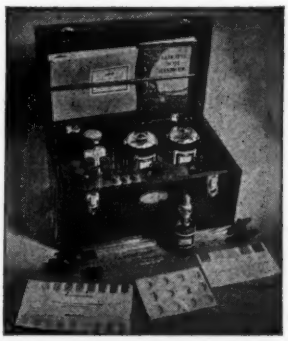

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Better Corn (Midwest) and (Northeast)

Reprints

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N-9 Problems of Feeding Cigarleaf Tobacco
F-3-40 When Fertilizing, Consider Plant-food Content of Crops
S-5-40 What Is the Matter with Your Soil?
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THE AMERICAN POTASH INSTITUTE

1155 16TH STREET, N. W. WASHINGTON 6, D. C.

One Sunday morning, just before service, a note was handed up to the Rev. Henry Ward Beecher. Opening it the famous clergyman discovered that it contained the single word: "Fool."

Mr. Beecher arose, described the communication to his congregation and added, with becoming seriousness: "I have known many an instance of a man writing a letter and forgetting to sign his name but this is the only instance I have ever known of a man signing his name and forgetting to write the letter."

MISTAKE

He: "There's a certain reason why I love you."

She: "My goodness!"

He: "Don't be ridiculous."

"Madam, what do you mean by letting your child snatch off my wig?"

"Sir, if it is just a wig, think nothing of it. I was afraid that the little devil had scalped you."

TOO MUCH FOR MAGGIE

A canvasser for a magazine house walked to the door of the prospect and knocked. A colored maid answered.

Canvasser: "Is the lady of the house in?"

Maid: "She's takin' a bath, suh!"

Canvasser: "I'd like to see her."

Maid (grinning): "I'se speck you would, white man."

The only way to get along with women is to let them think they're having their own way. The only way to do that is to let them have it.

SHORT-SHORT EPITAPH

The young reporter had been lectured about padding his stories, getting in too much uninteresting details. So when a fatal accident took place in the highest building in town, he reported it this way:

"Bill Walker, the janitor, looked up the elevator shaft in the Jones building this morning to see if the elevator was running. It was. Age 52. Funeral Tuesday morning, 11:30."

Spring fashion note: Young ladies will be wearing the same things in sweaters again this season.

Bachelor: "Sometimes I yearn for the peace and comfort of married life."

Married Friend (wistfully): "So do I."

Boy: "Where did I come from, Daddy?"

Father: "Well, er—you see, son, the bees fly from flower to flower—"

Boy: "Oh, I know all that stuff, but the kid next door is from Nashville. So where am I from?"

Diner: "This steak isn't very tender."

Waitress: "Sorry, sir, but the only affectionate things in this restaurant is us waitresses."

Many a chap with a plump waistline swings himself into the day's activities more deftly than the average lean and lanky type. He has cultivated poise and balance.

A fool and his money are some party.

Need for—

BORON IN AGRICULTURE

Authorities have recognized that the depletion of Boron in soil has been reflected in limited production and poor quality of numerous field and fruit crops.

Outstanding results have been obtained with the application of Borax in specific quantities or as part of the regular fertilizer mix, improving the quality and increasing the production of alfalfa and other legumes, table beets, sugar beets, apples, etc.

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Borax is economical and very little is required. It is conveniently packed in 100 lb. sacks and stocks are available for prompt delivery everywhere in the United States and Canada. Address your inquiries to the nearest office.

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BORAX

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20 Mule Team. Reg. U. S. Pat. Off.

The Meaning of

WHAT are those letters on your building blocks, little boy? What do they mean? Today you are too young to read or pronounce them, much less understand them.

But during the years ahead you will come to know and recognize V-C as the trademark for V-C Fertilizers manufactured by Virginia-Carolina Chemical Corporation to serve thousands of fine folks like you and your family.

Your Dad uses plenty of V-C Fertilizers for every crop he grows, to produce the largest possible profit from his land, labor and machinery . . . profit to buy you a good education and all the comforts and advantages that make life better and happier.

By helping each acre of your farm yield as much as several poorly-fertilized scrub acres would yield, V-C Fertilizers save work, worry and expense. This means more time for your Dad to spend with you . . . and more money for your Mother and Dad to make the farm a more attractive home for you and your brothers and sisters.

The older you grow, little boy, the more V-C will mean to you. V-C scientific research, V-C practical farm experience and V-C manufacturing skill are constantly at work developing better and better V-C Fertilizers . . . so that when you are a man and your Dad turns the farm over to you, it will be a better farm because he used V-C Fertilizers.

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VC FERTILIZERS

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● In furtherance of our policy—Serving Through Science—we developed and offered the agricultural world a new seed protectant, SPERGON, several years ago. In SPERGON we sought to provide the most effective, dependable and lasting protection for seed against soil-borne and other fungus diseases, along with complete safety for the user. Gratified at the remarkable reception and recognition given to SPERGON, our agricultural scientists have developed a new group of materials to aid the farmer in protecting his crop against loss or damage from plant diseases, insects, and weeds.

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PHYGON*—A Dichloro-Naphthoquinone compound of remarkable fungicidal value. Using as little as ½ lb. per hundred gallons of water gives a very effective spray for control of scab and blight diseases for fruit, flowers and vegetables. After application to the plant, PHYGON becomes water-insoluble—stays on through rains. PHYGON is also valuable used in powder form for treating seed of spinach, beets, and Swiss chard.

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SYNDEET—An improved DDT agricultural spray, in which a special synthetic oil, developed by our research, extends the killing power and range of DDT. Insects, such as aphids and mites, not removed by DDT alone, are destroyed by SYNDEET.

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SYNTONE—Rotenone emulsion spray of full strength and reliable effectiveness against specific pests.

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THE PLANT SPEAKS

A new four-reel series of 16 mm., sound, color films which may be booked independently or in any combination. They may be used to best advantage when shown at least one day apart and in the following sequence:

THE PLANT SPEAKS THRU DEFICIENCY SYMPTOMS pictures soil depletion, erosion, and deficiency symptoms on plants. (Running time 25 min. on 800-ft. reel.)

THE PLANT SPEAKS, SOIL TESTS TELL US WHY depicts taking soil samples on the farm and the interpretation of soil tests. (Running time 10 min. on 400-ft. reel.)

THE PLANT SPEAKS THRU TISSUE TESTS shows the value of tissue testing and the procedure for testing plant tissues in the field. (Running time 14 min. on 400-ft. reel.)

THE PLANT SPEAKS THRU LEAF ANALYSIS evaluates leaves in plant growth and leaf analysis in determining fertilizer needs. (Running time 18 min. on 800-ft. reel.)

We shall be pleased to loan these films to agricultural colleges, experiment stations, county agents, vocational teachers, responsible farm organizations, and members of the fertilizer trade.

OTHER 16MM. COLOR FILMS AVAILABLE FOR TERRITORIES INDICATED

Potash in Southern Agriculture (South)
In the Clover (Northeast)
Bringing Citrus Quality to Market (West)
Machine Placement of Fertilizer (West)
Ladino Clover Pastures (West)
Potash from Soil to Plant (West)
Potash Deficiency in Grapes and Prunes (West)
New Soils from Old (Midwest)
Potash Production in America (All)
Save That Soil (All)

IMPORTANT

Requests should be made *well in advance* and should include information as to group before which the film is to be shown, date of exhibition (alternative dates if possible), and period of time of loan.

American Potash Institute
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